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LEVEL 2 AND LEVEL 3 INSTRUMENTS IN EUROPEAN BANKS: EFFECTS ON DISCLOSURE AND CRASH RISK

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ABSTRACT

Level 2 and level 3 assets are complex and opaque financial instruments that are, at the moment, evaluated under the Pillar II by supervisory authorities. Investors have objective difficulties in assessing the risks involved and have to rely on supervisory judgment. Do investors trust the supervisory judgment? Does such type of investments increase bank crash risk? Focusing on European listed banks, we show that banks with a higher share of Level 3 assets have a higher synchronicity with market portfolio (R2), so a lower level of disclosure, and show a higher crash risk.

Keywords: Banking, risk, level 3, fair value hierarchy.

J.E.L. Classification: G21, G14, G32.

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"The assets and liabilities recorded in banks' balance sheets as Level 2 (L2) and Level 3 (L3) instruments play a key role, as their evaluation is particularly complex. Their value is not directly inferable from market prices but must be estimated using complicated techniques. Coupled with the difficulty of distinguishing between L2 and L3 contracts, this can lead banks to make valuations whose goal is to keep down capital requirements through accounting and regulatory arbitrage. […]. The total value of the complex instruments held by euro-area banks is very high. L3 and L2 assets total €162 billion and €3.3 trillion respectively; L3 and L2 liabilities amount to €143 billion and €3.1 trillion. The total amount of these instruments is twelve times greater than that of net nonperforming loans."

Fabio Panetta,
Deputy Governor of the Bank of Italy, speech entitled:
"The Italian banking system and the exit from the crisis"
Italian Banking Association conference on
Banking Union and Basel III - Risk & Supervision 2017.
Rome, 14 June 2017

1. Introduction

European banking regulators and supervisors have paid great attention over the last few years to the issue of credit quality and Non-Performing Loans (NPLs), which, having reached almost one trillion euros at the end of 2016, represent a serious threat to the stability of the system. NPLs are not the "only" source of instability and there have been various warnings of the risks inherent in investment and Level 2 (L2) and, above all, Level 3 (L3) funding by European banks. In this regards, Panetta (2017, page 4) is symptomatic: "*Because of their high degree of complexity and low level of standardization, L2 and L3 instruments are illiquid; their quick sale would likely entail a substantial discount on their fair value"* and also: "*Moreover, the actual value of L2 and L3 portfolios is difficult to assess, as it cannot be inferred from the prices recorded in the markets but is instead estimated using models based on variables whose liquidity is also low or nil*". At the moment, L2 and L3 items do not represent an immediate alarm, as recently pointed out by Nouy (2018), answering the question if there was too much attention on the theme of NPLs, while there was not enough on the theme of derivatives: "*Well, we look at all risks. We assess all risks and we try to get mitigants for all risks. About the comparison which is made quite often with these Level 3 or Level 2 assets, let me say that we are conducting rigorous reviews of valuation on pricing models for market risk. We investigate market risk aspects both in internal models, in off-site supervision and in on-site supervision with missions. Those risks are taken into account in the SREP methodology. We have also horizontal benchmarks that are used for this kind of risk. Also it is part of the capital surcharge for global SIFIs. It's even part in two boxes, two elements, two criteria of the global SIFIs methodology. One is the complexity element and one is the resolvability element. So it is covered, in my view, and we will certainly*

not stop covering it because those are important elements and important risks. We think that we are looking across all risk for all banks"[1].

There is no doubt that L2 and L3 items can entail high costs due to their complexity and low standardisation, and that operators have objective difficulties in assessing the risks involved, partly due to the lack of transparency and information provided to the market on these financial statement items. The classification of financial instruments in Level 1 (L1), L2 and L3 is relatively new for the Italian accounting tradition and derives from the "hierarchy" introduced by the International Financial Reporting Standards (IFRS) no. 7, which came into force in 2007, and then by the IFRS no. 13, applicable from 2013. This classification is based on inputs that can be used to estimate fair value. L1 is assigned to assets and liabilities whose fair value can be immediately determined by means of the market price; L2 includes assets and liabilities whose fair value cannot be immediately obtained from the market, but can be determined using calculation models whose input data can be directly observed in financial markets. L3 contains assets and liabilities whose fair value is not observable in the market, nor can it be obtained using models that use data observable in the market. Fair value can therefore be estimated, in order of priority, through: (i) observable data, but only secondary to the assets and liabilities to be measured, such as quoted prices for identical assets or liabilities in non-active markets; (ii) non-observable input data, based on assumptions defined by the valuers. With the inevitable limitations of attempting to simplify a complex classification, a bank should include in the first level all securities held or issued that are listed on regulated markets; in the second level, unlisted securities; and in the third level, complex Over the Counter (OTC) derivatives or structured obligations.

The size of the phenomenon is very high overall: the sum of L2 and L3 assets and liabilities is €6.8 trillion (€3.6 trillion on the assets side; €3.2 trillion on the liabilities side) at the end of 2016[2]. Thus, it is not surprising that there is increasing attention to the risks inherent in such instruments, as witnessed by the media, academic contributions (e.g. Roca et al., 2017; D'Apice et al., 2016; Mohrmann and Riepe, 2017), and institutional debates (European Parliament and European Central Bank; see, for example, the European Parliament Resolution of 15 February 2017). This leads us to the following research questions: do financial firms with a higher share of L3 assets have a higher R^2? Do financial firms with a higher share of L3 assets have a higher crash risk? We provide a first evidence that: (i) financial firms with a higher

[1] Danièle Nouy, Chair of the Supervisory Board of the European Central Bank.
[2] Source of data: Panetta (2018, p. 8)

share of L3 assets have a higher R^2, so a lower transparency; (ii) financial firms with a higher share of L3 assets show a higher crash risk.

The identification strategy is based on two main firm fixed effects models, where the dependent variables are measures of synchronicity and crash risk. The main contribution of our paper is that we directly link L2 and L3 assets to large measures of risks based on the stock returns. We would like to point out that our aim is not to assess the risk inherent in these instruments (which is not possible for external analysts and, indeed, only possible for the banks themselves and the supervisory authorities as part of the Supervisory Review and Evaluation Process -SREP, as stressed by Nouy, 2018). Rather, we provide evidence of the investors' perception about these instruments by providing novel evidence: past papers (e.g. Roca et al., 2017) have reported the exposure amount of these instruments, but not an external assessment of their risks. Our results have important insights for all parts in financial markets. Bankers need to be aware that investors perceive L2 and L3 items as risky assets. Supervisors need to be aware that, without a highly prudential capital requirement (e.g. a complete equity coverage of high risky L2 and L3 items), it is their fully responsibility to check the real risks involved in such instruments and these cannot be assessed by external analysts. Accounting standard setters need to realize that letting banks to report such non-transparent items make financial statements less meaningful for investors so that the banks' stock return is more aligned to market returns.

The follow-up is organized as follows: in Section 2, we review past papers and develop our research hypotheses; data and the econometric approach are provided in Section 3 and we discuss results in Section 4. Section 5 concludes the paper.

2. Literature, Hypotheses and Contribution

There is a large literature dealing with the opacity of the banking business (Morgan, 2002) and showing that, despite the strengthening of market discipline as the third pillar of Basel 2, market information was not able to provide significant warning against the crisis (Flannery, 2012). As outlined by Jones et al. (2013), opacity may arise from three sources: i) incomplete disclosure, ii) interpretation of available information in contradictory ways, and iii) fundamental complexity of business that makes accurate

valuation nearly impossible. Using a sample of US banks of financial holding companies, the authors analyze the relationship between investments in opaque assets and price synchronicity, finding that large investments in opaque assets increase price synchronicity. The basic idea is that firms that are more opaque release less specific information to the public. Consequently, the firm stock return of opaque firms moves more closely with the broad market index, exhibiting a high level of market synchronicity (see, for example, Hutton 2009).

Using a sample of 98 listed US bank holding companies, Dewally and Shao (2013) examine the link between opacity and price synchronicity focusing on the use of interest rate and foreign exchange derivatives. Empirical findings outline a positive relationship between derivatives usage and price synchronicity.

A small number of papers (Riedl and Serafeim, 2011; Liao et al., 2013; Magnan et al., 2015) investigate the issue of opacity and price synchronicity dealing with fair value accounting. Riedl and Serafeim (2011) analyze a sample of US financial institutions, including 952 firm-quarter observations from 2Q 2007 through 2Q 2008. Results show that firms having a greater exposure to opaque assets report a higher cost of capital, reflecting a higher information risk. Liao et al. (2013) use the bid-ask spread as a proxy for information asymmetry, finding that it is positively related to fair value net assets, with bid-ask spreads increasing from L1 to L3. Focusing on a sample of US bank holding companies, Magnan et al. (2015) find that L3 measurement is associated with more dispersed analyst forecasts.

At our knowledge, there are no studies investigating the relationship between the holding of L3 assets and price synchronicity for European banks. We contribute to the existing literature testing the following hypothesis:

Hypothesis 1: Financial firms with a higher share of L3 assets have higher R^2 (lower transparency).

A small number of papers investigates the relationship between fair value assets and risk. Riedl and Serafeim (2011) outline that information risk increases when more subjective inputs are used to derive the fair value estimation (e.g., for L2 and L3 assets). In the opinion of the authors, information risk is hardly

diversifiable, since the uncertainty surrounding the future cash flows of financial assets can be highly correlated across financial institutions, due to the exposure to similar types of contracts; consequently, investors require a higher cost of capital when facing higher information risk. The authors provide empirical support to this hypothesis finding a positive relationship between equity beta and fair value assets (with increasing coefficients from L1 to L3). A different approach is used by Mohrmann and Riepe (2017), analyzing a large sample of 644 listed banks of US banks, over 2008-2012. The authors find a positive relationship between the bank's Merton probability of default and the share of L3 assets.

As far as we are aware, there are no studies investigating the impact of L3 assets on tail risk. However, the idea of a positive link between opaque assets and tail risk is not completely new in the literature. Dewally and Shao (2013) show that the use of financial derivatives leads to a higher likelihood of extreme outcomes. This happens since opaque assets can facilitate management's temporary withholding of bank-specific information; when this information is negative and is finally revealed to the market, the stock price may experience a serious crash. At our knowledge, there are no empirical analyses assessing the relationship between the holding of L3 assets and stock price crash risk. We contribute to the existing literature by testing the following hypothesis:

Hypothesis 2: Financial firms with higher share of L3 assets have higher crash risk.

3. Data and econometric approach

In this section, we describe the data and the econometric models we employ in the analysis of the relation between (i) L3 assets and transparency and (ii) L3 assets and crash risk. Initially, from Orbis Bank Focus of Bureau Van Dijk, we collect firm-level data for all listed financial firms in the European Union from 2012 to 2015. Then we merge the balance sheet data of these 275 firms with other market-based measurements gathered from Thomson Reuters. Taking into account data availability, our final sample is composed of 148 financial firms located in 23 countries.

3.1. L3 assets and transparency: models

We start our investigation of the relation between L3 assets and transparency by estimating the following firm fixed effects model:

$$SYN_{i,t} = \alpha_i + \beta_1\ L3\ SHARE_{i,t-1} + \lambda'\ CTRL\ VARS_{i,t-1} + \pi'\ year*country + \varepsilon_{i,t} \quad (1)$$

where $SYN_{i,t}$ is our measure of synchronicity for financial firm *i* in year *t*. To obtain this measure, following previous studies (e.g., Hutton et al., 2009; Dewally and Shao, 2013), we run an augmented market model, including lag and lead terms for market returns:

$$r_{i,t} = \alpha_i + \beta_1 r_{m,t-2} + \beta_2 r_{m,t-1} + \beta_3 r_{m,t} + \beta_4 r_{m,t+1} + \beta_5 r_{m,t+2} + \varepsilon_{i,t} \quad (2)$$

where $r_{i,t}$ is the return for firm *i* in week *t*, and $r_{m,t}$ is the market index return in the same period. We use a broad stock index for Europe, i.e. the MSCI Europe All Cap. The firm's synchronicity is given by the R-squared of the model, while the firm-specific volatility is given by $(1-R^2)$. We use a logistic transformation to avoid a measure bounded between 0 and 1:

$$SYN_{it} = ln\left(\frac{1-R^2_{i,t}}{R^2_{i,t}}\right) \quad (3)$$

A high value of $SYN_{i,t}$ indicates a low level of market synchronicity, and hence, a high level of disclosure of firm-specific information.

In equation (1), our test variable is $L3\ SHARE_{i,t-1}$, namely the lagged value of L3 assets over total assets. As said, L3 assets are those financial instruments whose fair value is measured using internal methodologies developed by the banks, as it cannot be measured by reference to quoted prices in active

markets (L1 assets) or by using benchmarks (L2 assets). If financial firms with higher share of L3 assets have higher R^2 (lower transparency), as stated in Hypothesis 1, we expect a negative sign for regression coefficient β_1.

CTRL VARS$_{i,t-1}$ includes the lagged value of control variables. In line with the relevant literature on this topic, we use the natural logarithm of total assets (*SIZE*), return on assets for profitability (*ROA*), total equity over total assets (*CAP*), liquid assets over total assets for liquidity (*LIQ*) and the market-to-book ratio (*MTB*).

We include the interaction term *year*country*$_{i,t}$ to capture time and country specific effects on transparency.

To better understand the relation between L3 asset and transparency, we also estimate a different version of model (1), splitting L3 assets in two subcategories:

$$SYN_{i,t} = \alpha_i + \beta_1\ L3\ FA\ SHARE_{i,t-1} + \beta_2\ L3\ OTH\ SHARE_{i,t-1} + \lambda'\ CTRL\ VARS_{i,t-1} + \pi'\ year*country + \varepsilon_{i,t} \quad (4)$$

L3 FA SHARE$_{i,t-1}$ is the lagged value of the sum of L3 held for trading, available for sale and held to maturity assets over total assets; *L3 OTH SHARE*$_{i,t-1}$ is the share of L3 assets related to other categories such as loans and receivables. We present the results of models (1) and (4) in Section 4.1.

3.2 L3 assets and crash risk: models

To investigate the relation between L3 assets and crash risk, we estimate different versions of the following firm fixed effects model:

$$CRASH\ RISK_{i,t} = \alpha_i + \beta_1\ L3\ SHARE_{i,t-1} + \lambda'\ CTRL\ VARS_{i,t-1} + \pi'\ year*country + \varepsilon_{i,t} \quad (5)$$

where CRASH $RISK_{i,t}$ is the risk of crash of firm *i* in year *t* and it is proxied by three different measures: $CRASH\_JUMP_{i,t}$, the number of crashes minus the number of jumps is a given year; $NCSKEW_{i,t}$, the negative of the third moment of firm-specific weekly returns, divided by the cube standard deviation (see, for example, Callen and Fang, 2015):

$$NCSKEW_{i,t} = -\frac{[n(n-1)^{3/2}\sum w_{i,t}^3]}{[(n-1)(n-2)(\sum w_{i,t}^2)^{3/2}]} \quad (6)$$

where $w_{i,t}$ are the firm-specific weekly returns.

The third measure is the $DUVOL_{i,t}$, which is down-to-up volatility measured as the natural logarithm of the ratio of the standard deviation in the crash weeks to the standard deviation in the jump weeks:

$$DUVOL_{i,t} = \ln\left(\frac{(n_j - 1)\sum_{crash}\varepsilon_{i,t}^2}{(n_c - 1)\sum_{jump}\varepsilon_{i,t}^2}\right) \quad (7)$$

$CTRL\ VARS_{i,t-1}$ includes the lagged value of the control variables describe in Section 3.1. We also control for year and country specific effects (i.e., $year*country_{i,t}$). Also in this analysis, to test whether different categories of L3 assets have different impact on crash risk, we estimate the following model:

$$CRASH\ RISK_{i,t} = \alpha_i + \beta_1\ L3\ FA\ SHARE_{i,t-1} + \beta_2\ L3\ OTH\ SHARE_{i,t-1} + \lambda'\ CTRL\ VARS_{i,t-1} + \\ + \pi'\ year*country + \varepsilon_{i,t} \quad (8)$$

We present the results of models (5) and (8) in Section 4.2.

Table 1 presents the descriptive statistics of variables used in the empirical analysis. In our sample, the average bank has a L3 share of 7.8%; while for the median bank it is 0.6%. The standard deviation of the L3 assets share distribution is relatively high at 19.9%. Moreover, the bottom 25% of the banks in our sample has a L3 share lower than 0.2%; while the upper 25% of the banks has a L3 share higher than 2.1%.

4. Results

In this section, we report the results of the various models described previously. We start from the relation between L3 assets and financial firm transparency.

4.1 L3 assets and transparency: results

The evidence corresponding to the models (1) and (4) is reported in Table 2. When we use just *L3 SHARE*, the coefficient is significantly negative (column 1). Thus, Hypothesis 1 is verified and, *ceteris paribus*, we find that financial firms with a higher share of L3 assets have lower transparency. When we look at the two subcategories, we find that both coefficients are significant (columns 2 and 3), but we notice that the effect of L3 financial assets is stronger (column 4). Overall, our results provide evidence that investors perceive financial firms with a strong presence of L3 assets as opaque. This is consistent with previous findings in the banking literature, related to the presence of derivatives (e.g., Dewally and Shao, 2013).

4.2 L3 assets and crash risk: results

In this section, we present the empirical evidence corresponding to the relation between L3 assets and crash risk described in Section 3.2. Table 3 presents the results of model (5) and model (8) using *CRASH_JUMP* as a first proxy of crash risk. In this case, with a proxy able to vary between -2 and 2, we find that the coefficient of *L3 FA SHARE* is significantly positive (column 2); while the coefficient of *L3 OTH SHARE* is not. Thus, with this model specification, Hypothesis 2 is verified and, *ceteris paribus*, we find that financial firms with a higher share of L3 financial assets have a higher crash risk.

Table 4 presents the result of model (5) and model (8) using *NCSKEW* as a second proxy of crash risk. With a continuous dependent variable, we confirm the previous results: we find that the coefficient of *L3 FA SHARE* is significantly positive. Thus, Hypothesis 2 is verified and, *ceteris paribus*, we find that financial firms with a higher share of L3 financial assets have higher negative conditional return skewness, i.e., they are more prone to large negative returns, that is, crashes.

Table 5 presents the result of model (5) using *DUVOL* as a third proxy of crash risk. Here we find further evidence confirming previous results. Indeed, the coefficient of *L3 FA SHARE* is significantly positive. Thus, Hypothesis 2 is verified and *ceteris paribus*, we find that financial firms with a higher share of L3 financial assets have higher down-to-up volatility (i.e., they are more prone to large negative price movements as the volatility of negative returns is higher than those of positive returns). Overall, our findings suggest that financial firms with a high share of L3 assets are more prone to particularly negative results.

5. Conclusions

In the last years, the debate on L3 assets has gained increasing attention. The valuation of these assets has been commonly recognized as critical (see, for example, Panetta 2017), since it is based on estimates and cannot confide on market quotations. As a consequence, not only the value, but also the entire amount of L3 assets in the banks' balance sheets is difficult to assess and rely on. In this paper, we assess whether financial firms having a higher share of L3 assets have a lower level of disclosure and a higher crash risk. We refer to price synchronicity to measure transparency and we use three different variables to measure crash risk. By using two main firm fixed effect models, we provide evidence that financial firms having L3 assets show a lower transparency and a higher crash risk. Consistently with previous literature, the holding of complex and illiquid assets results in both less transparency and more risk, being a potential source of fragility for the entire financial firms. Our results call for the attention of several stakeholders. Investors consider L3 assets as opaque and risky. Supervisors and accounting standard setters should reconsider the regulatory treatment of these instruments, or at least, make bank managers providing more comprehensive and standardized information about them. On the last point, we signal indeed a not

homogeneous classification in the balance sheets of banks. For example, some banks exclude derivatives from the table displaying the subdivision in three levels (L1, L2 and L3) of financial items, while other banks include loans and receivables. This lack of homogeneity contributes to increase the opacity of L3 assets, and therefore their riskiness at investors' eyes.

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Table 1: Summary statistics

This table describes the summary statistics of the variables that we used in our empirical analysis.

Variables	Mean	SD	P25	Median	P75
Dependent variables					
SYN	1.15	1.1	0.47	1.11	1.85
CRASH	0.23	0.42	0	0	0
CRASH_JUMP	-0.07	0.68	0	0	0
NCSKEW	-0.1	0.88	-0.53	-0.05	0.31
DUVOL	-0.06	0.55	-0.39	-0.07	0.26
Test variables					
L3 SHARE	7.83	19.88	0.17	0.57	2.13
L3 FA SHARE	1.05	4.74	0	0.14	0.49
L3 OTH SHARE	6.73	19.42	0	0.07	0.82
Control variables					
SIZE	9.88	2.58	8.21	9.77	11.97
ROA	0.66	3.5	0.07	0.43	1.07
CAP	14.94	20.04	5.79	8.57	12.69
LIQ	23.7	22.05	8.02	17	29.32
MTB	6.38	31.88	0.55	0.96	3.96

Table 2: L3 assets and disclosure

This table shows the estimation of several firm fixed effects models, starting from equation (1), that investigate the relation between L3 assets and transparency:

$$SYN_{i,t} = \alpha_i + \beta_1\ L3\ SHARE_{i,t-1} + \lambda'\ CTRL\ VARS_{i,t-1} + \pi'\ year*country + \varepsilon_{i,t}$$

where the dependent variable SYN is our measure of transparency for financial firm. Our test variable is *L3 SHARE*, namely the lagged value of L3 assets over total assets. Standard errors are reported in parenthesis. ***, ** and * indicate significance at the 1%, 5% and 10% levels.

	SYN 1.1	SYN 1.2	SYN 1.3	SYN 1.4
L3 SHARE	-0.006**			
	(0.003)			
L3 FA SHARE		-0.115**		-0.112**
		(0.054)		(0.054)
L3 OTH SHARE			-0.005*	-0.005*
			(0.003)	(0.003)
SIZE	0.024	-0.043	0.026	-0.034
	(0.293)	(0.297)	(0.293)	(0.298)
ROA	-0.003	-0.011	-0.003	-0.010
	(0.012)	(0.012)	(0.012)	(0.012)
CAP	-0.004	-0.005	-0.005	-0.004
	(0.006)	(0.006)	(0.006)	(0.006)
LIQ	0.019**	0.020**	0.019**	0.018**
	(0.008)	(0.009)	(0.008)	(0.008)
MTB	-0.002**	-0.002**	-0.002**	-0.002**
	(0.001)	(0.001)	(0.001)	(0.001)
Constant	0.580	1.148	0.428	1.320
	(2.883)	(2.895)	(2.879)	(2.890)
Obs	463	463	463	463
Banks	148	148	148	148
R2	0.019	0.023	0.005	0.003
year*country	Yes	Yes	Yes	Yes
Bank F.E.	Yes	Yes	Yes	Yes

Table 3 - L3 assets and crash risk (measured as the number of crashes minus the number of jumps in a given year)

This table shows the estimation of several firm fixed effects models, starting from equation (5), that investigate the relation between L3 assets and crash risk, where the dependent variable CRASH RISK is proxied by CRASH_JUMP, the number of crashes minus the number of jumps is a given year. Our test variable is *L3 SHARE*, namely the lagged value of L3 assets over total assets. Standard errors are reported in parenthesis. ***, ** and * indicate significance at the 1%, 5% and 10% levels.

	CRA_JUM 3.1	CRA_JUM 3.2	CRA_JUM 3.3	CRA_JUM 3.4
L3 SHARE	-0.002			
	(0.004)			
L3 FA SHARE		0.145***		0.146***
		(0.053)		(0.054)
L3 OTH SHARE			-0.002	-0.003
			(0.004)	(0.004)
SIZE	0.152	0.227	0.153	0.232
	(0.270)	(0.285)	(0.269)	(0.283)
ROA	0.016*	0.026**	0.017*	0.026**
	(0.010)	(0.013)	(0.010)	(0.013)
CAP	0.011	0.010	0.011	0.010
	(0.007)	(0.007)	(0.007)	(0.007)
LIQ	0.002	0.005	0.002	0.004
	(0.010)	(0.010)	(0.010)	(0.010)
MTB	0.000	0.000	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)
Constant	-1.670	-2.750	-1.619	-2.606
	(2.652)	(2.810)	(2.645)	(2.811)
Obs	463	463	463	463
Banks	148	148	148	148
R2	0.098	0.058	0.087	0.057
year*country	Yes	Yes	Yes	Yes
Bank F.E.	Yes	Yes	Yes	Yes

Table 4 - L3 assets and crash risk (measured as the negative conditional skewness)

This table shows the estimation of several firm fixed effects models, starting from equation (5), that investigate the relation between L3 assets and crash risk, where the dependent variable CRASH RISK is proxied by NCSKEW, the negative of the third moment of firm-specific weekly returns, divided by the cube standard deviation. Our test variable is *L3 SHARE*, namely the lagged value of L3 assets over total assets. Standard errors are reported in parenthesis. ***, ** and * indicate significance at the 1%, 5% and 10% levels.

	NCS	NCS	NCS	NCS
	4.1	4.2	4.3	4.4
L3 SHARE	-0.002			
	(0.004)			
L3 FA SHARE		0.134**		0.135**
		(0.061)		(0.061)
L3 OTH SHARE			-0.002	-0.002
			(0.004)	(0.005)
SIZE	0.366	0.437	0.368	0.441
	(0.327)	(0.343)	(0.327)	(0.342)
ROA	0.020*	0.029**	0.020*	0.029**
	(0.011)	(0.014)	(0.011)	(0.014)
CAP	0.012	0.011	0.012	0.011
	(0.008)	(0.007)	(0.008)	(0.007)
LIQ	0.009	0.011	0.008	0.010
	(0.014)	(0.014)	(0.014)	(0.014)
MTB	-0.001	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Constant	-3.559	-4.559	-3.573	-4.407
	(3.173)	(3.352)	(3.173)	(3.349)
Obs	463	463	463	463
Banks	148	148	148	148
R2	0.082	0.060	0.040	0.069
year*country	Yes	Yes	Yes	Yes
Bank F.E.	Yes	Yes	Yes	Yes

Table 5 - L3 assets and crash risk (measured as the down-to-up-volatility)

This table shows the estimation of several firm fixed effects models, starting from equation (5), that investigate the relation between L3 assets and crash risk, where the dependent variable CRASH RISK is proxied by DUVOL, which is down-to-up volatility measured as the natural logarithm of the ratio of the standard deviation in the crash weeks to the standard deviation in the jump weeks. Our test variable is *L3 SHARE*, namely the lagged value of L3 assets over total assets. Standard errors are reported in parenthesis. ***, ** and * indicate significance at the 1%, 5% and 10% levels.

	DUVOL	DUVOL	DUVOL	DUVOL
	5.1	5.2	5.3	5.4
L3 SHARE	0.000			
	(0.003)			
L3 FA SHARE		0.081*		0.081*
		(0.041)		(0.041)
L3 OTH SHARE			0.000	-0.000
			(0.003)	(0.003)
SIZE	0.142	0.185	0.142	0.185
	(0.176)	(0.183)	(0.176)	(0.183)
ROA	0.008	0.013	0.008	0.013
	(0.007)	(0.008)	(0.007)	(0.008)
CAP	0.007	0.007	0.007	0.007
	(0.006)	(0.006)	(0.006)	(0.006)
LIQ	-0.004	-0.003	-0.004	-0.004
	(0.007)	(0.007)	(0.007)	(0.007)
MTB	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.001)
Constant	-1.242	-1.705	-1.151	-1.723
	(1.709)	(1.787)	(1.708)	(1.793)
Obs	463	463	463	463
Banks	148	148	148	148
R2	0.134	0.086	0.069	0.077
year*country	Yes	Yes	Yes	Yes
Bank F.E.	Yes	Yes	Yes	Yes