INDUSTRY BETAS LEVERED AND UNLEVERED
134 INDUSTRIES – 10 GEOGRAPHICAL AREAS

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Table of contents

I – DESCRIPTION OF METHOD USED

About industry betas

Tables in Section III of this research are showing industry betas, *levered* and *unlevered*, estimated[1] on the basis of individual betas of shares issued by thousands of companies quoted on stock exchanges worldwide. Industry betas have been calculated as arithmetic averages of individual betas. They have been aggregated by industry as well as by geographical areas[2].

Industry betas can be useful when estimating cost of capital because they tend to be less sensitive to errors that may affect calculation of individual betas:

- as a consequence of special market situations or of other extraordinary events involving underlying companies, individual betas sometimes result over- or underestimated;

- since industry betas are determined as averages of individual stock betas, over- and underestimations tend to compensate each other.

An average (industry) beta can, therefore, be generally considered to be more meaningful for the purpose of cost of capital calculation than its underlying individual stock betas.

Selection of individual betas

In order to estimate industry betas, we have collected individual betas of listed companies:

- having a minimum market capitalization of Euro 50 million in the last five years;

- whose shares daily traded value was never less to one hundredth of their average market capitalization in the last five years.

In our opinion, the requirements above constitute a reasonable compromise between:

- the need to collect a vast number of individual betas to be able to calculate as many industry betas as possible;

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[1] Our estimates are based on industry, stock market and financial data provided by Standard & Poor's Capital IQ

[2] We have calculated a "global" value of each industry beta. Additionally the tables feature also "regional" values for following areas: *European Union and Western Europe, Russia and Eastern Europe*, *Southern and Eastern Mediterranean Countries*, *States of the Persian Gulf*, *Sub-Saharan Africa*, *Central and South Asia*, *East Asia*, *Pacific States*, *South America*, *North America*.

- the necessity to avoid companies that are too small and/or whose shares may be thinly traded, since their individual betas may be not meaningful.

Estimating individual *levered* betas

For each company selected we have estimated a set of two *levered* betas:

- *calculation technique*: regression of return of company shares to market return, applied over two distinctive periods of five and of two years considering, respectively, monthly and weekly returns;

- *market return*: we have assumed as a proxy the return of the local stock market index of reference for the underlying company.

Individual *levered* betas calculated over a five years regression period appear, generally, to be less dispersed around market beta than two years regression ones. The latter, due to the shorter regression period, may result more affected by volatility of underlying shares return to index return, but also better reflect underlying company's recent operating and risk profiles.

Estimating individual *unlevered* betas

Based on their *levered* betas, we have calculated *unlevered* betas of all companies different than those belonging to financial industries (banks and insurances). We have estimated *unlevered* betas using two different techniques, depending on whether the underlying company's gross debt less "cash[3] and equivalents" is greater than (net debt) or lower than (net liquidity) zero.

Unlevered Beta – Net debt

In the case of existing net debt (gross debt being higher than cash and equivalents), we have used a simplified version[4] of Hamada's formula to extract *unlevered* beta from one stock's *levered* five years and two years betas:

$$\beta_{unlevered} = \frac{\beta_{levered}}{1 + (1 - t) \times \frac{D}{E}}$$

where:

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[3] Amount of liquidity has been adjusted to properly reflect s.c. "working cash". See T. Coller, M. Goedhart, D.Wessels *Valuation*, Wiley, 2010, pag. 143

[4] The implied assumption is that debt beta may not be meaningful. To be consistent with this assumption, we have discarded betas of companies with an excessive level of indebtedness.

- "D": gross debt (adjusted for pension liabilities and similar provisions) less cash and equivalents;

- "E": market capitalization adjusted for minority interests;

- "t": effective tax rate.

"D", "E" and "t" used in the above formula are, respectively, 5 years or 2 years average values, depending on regression period of *levered* betas.

Unlevered Beta – Net liquidity

In case of existing net liquidity (gross debt lower than cash and equivalents), a company's market capitalization "E" can be assumed to be the sum of two components, the first consisting in the market value of its business "E_b" and the second being its net liquidity "E_{liq}":

$$E = E_b + E_{liq}$$

The equation above can also be rewritten as follows:

$$E = (E - E_{liq}) + E_{liq}$$

The company's *levered* beta should be equal to the weighted average of beta of its net liquidity and beta of its business. The latter should therefore correspond to the "true" *unlevered* beta:

$$\beta_{levered} = \beta_{Eb} \frac{(E - E_{liq})}{E} + \beta_{E_{liq}} \frac{E_{liq}}{E}$$

Assuming that net liquidity's beta is equal to zero, β_{Eb} can be calculated as follows[5]:

$$\beta_{Eb} = \frac{\beta_{levered}}{\frac{(E - E_{liq})}{E}}$$

In the end, for D equal to E_{liq}, the formula can be rewritten as:

$$\beta_{unlevered} = \frac{\beta_{levered}}{\frac{(E - D)}{E}}$$

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[5] M. Massari, G. Gianfrate, L. Zanetti *Corporate Valuation*, Wiley, 2016, pag. 216-218

***Levered* and *unlevered* industry betas**

Before calculating industry *levered* and *unlevered* betas as averages of individual *levered* and *unlevered* betas respectively, we have screened out outliers and/or otherwise meaningless values[6].

The *unlevering* technique illustrated above implies that the risk of operating activity of a company is not influenced by net liquidity and that, therefore, one can calculate *unlevered* beta as shown before. In our opinion, however, this assumption may not correspond to reality, since decisions taken by management, all other circumstances being equal, may be different in case of the company's gross debt being higher or lower than cash and equivalents. We therefore have computed industry betas (both for five and for two years individual betas regression periods) from two different perspectives, as outlined below.

Industry betas "net liquidity included"

We have calculated industry betas, both *levered* and *unlevered*, by averaging individual *levered* and *unlevered* betas, considering companies having net liquidity.

Industry betas "net liquidity excluded"

We have calculated industry betas, both *levered* and *unlevered*, by averaging individual *levered* and *unlevered* betas, screening out companies having net liquidity.

Data tables

Summary

The first data table shows a summary of *levered* and *unlevered* industry betas, reporting their lowest, their highest and their average values, rounded to the second decimal place. Industry betas are grouped by length of regression time period (2Y or 5Y), and sorted also by said inclusion or exclusion of net liquidity companies.

Industry betas

Single industry beta tables show *levered* and *unlevered* betas rounded to the second decimal place. They are aggregated:

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[6] We also screened out individual betas of companies showing negative or unusually high average effective tax rates.

- *by column*: on the basis of the length of regression period (5Y or 2Y) and by inclusion or exclusion of net liquidity companies;

- *by raw*: on geographical basis (ten different regional values and one global value).

Tables also show the number of individual betas underlying their average (industry) values[7]:

	β_L	n.	β_U	n.	β_L	n.	β_U	n.
Oil & Gas Drilling								
30-giu-2017	5Y net liq. incl.				5Y net liq. excl.			
European Union and Western Europe	0,76	3	0,47	3	0,76	3	0,47	3
Russia & Eastern Europe	-	-	-	-	-	-	-	-
Southern & Eastern Mediterranean	-	-	-	-	-	-	-	-
States of the Persian Gulf	-	-	-	-	-	-	-	-
Sub-Saharan Africa	-	-	-	-	-	-	-	-
Central & South Asia	-	-	-	-	-	-	-	-
East Asia	1,11	3	0,98	3	1,11	3	0,98	3
Pacific States	-	-	-	-	-	-	-	-
South America	1,09	1	0,66	1	1,09	1	0,66	1
North America	1,50	7	1,17	7	1,48	6	1,10	6
Global	1,22	14	0,94	14	1,20	13	0,89	13

When the number of individual betas for a specific geographical area is too small, it may be better to refer to the global value of industry beta. As an alternative, one could adjust average values resulting from a too limited underlying set of individual betas using the Blume's technique[8].

Disclaimer

We have estimated industry betas by relying upon third party industry, stock market and financial data of thousands of listed companies. We have not verified such data. All information contained in this publication is presented without any claim of accuracy, completeness and absence of errors. Computational mistakes

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[7] *How to read the industry beta tables*: A = reference date of industry beta calculation; B = industry; C = rows of industry beta values aggregated by geographical area; D = columns displaying values of levered (β_L) and unlevered (β_U) industry betas; E = regression period, 5Y or 2Y: betas are aggregated in different columns depending on whether companies with net liquidity were or were not included in the industry betas calculation; F = columns displaying the number of individual betas underlying the values of industry betas; G = sample values of levered and unlevered industry betas; H = sample quantity of individual betas underlying corresponding industry betas values

[8] Beta adjusted = Beta x 2/3 + 1/3

can occur frequently when, like in this case, complex calculations are made by using a huge amount of information data.

We may, in future, modify our criteria of calculation of industry betas as well as change any content of this publication.

All information contained in this publication is provided *as is*. It is to be used at the reader's own risk only. We do not undertake any responsibility in case of negative consequences that may result to anybody, directly or indirectly, from using industry betas and/or any other information contained in this publication.

II –INDUSTRIES

Fossil fuel industry

Basic materials