18 topics badly explained by many Finance Professors[1]

Pablo Fernandez. Professor of Finance. IESE Business School. Camino del Cerro del Aguila 3. 28023 Madrid, Spain
PhD. Business Economics (Finance). Harvard University. e-mail: fernandezpa@iese.edu

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This paper addresses 18 finance topics that are badly explained by many Finance Professors. The topics are:

1. Where does the WACC equation come from?
2. The WACC is not a cost
3. The WACC equation when the value of debt is not equal to its nominal value
4. The term equity premium is used to designate four different concepts
5. Textbooks differ a lot on their recommendations regarding the equity premium
6. Which Equity Premium do professors, analysts and practitioners use?
7. Calculated (historical) betas change dramatically from one day to the next
8. Why do many professors still use calculated (historical) betas in class?
9. EVA does not measure Shareholder value creation
10. The relationship between the WACC and the value of the tax shields (VTS)
11. Beta and CAPM do not explain anything about expected or required returns
12. Difference between the expected and the required rates of return
13. It has been very easy to beat the S&P500 in 2000-2018
14. Apply the logic principle "*Never buy a hair growth lotion from a man with no hair*" to your investment advisors… and to your professors
15. Rational investing in equities
16. Volatility is a bad measure of risk.
17. About the unhelpfulness of the Sharpe ratio.
18. Common errors in portfolio management and wrong advices

Exhibit 1. Calculating the WACC
Exhibit 2. Capital Asset Pricing Model (CAPM)
Exhibit 3. Comments from readers

1. Where does the WACC equation come from?

The WACC is just the rate at which the Free Cash Flows (FCF) must be discounted to obtain the same result as the valuation using Equity Cash Flows.

There are two basic methods for valuing companies by discounted cash flows:

Method 1. Using the expected equity cash flow (ECF) and the required return to equity (Ke).

Equation [1] indicates that the value of the equity (E) is the present value of the expected equity cash flows (ECF) discounted at the required return to equity (Ke).

[1] $E_0 = PV_0 [Ke_t; ECF_t]$

[1] I am very grateful to the alumni, professionals and professors that sent comments.

Equation [2] indicates that the value of the debt (D) is the present value of the expected debt cash flows (CFd) discounted at the required return to debt (Kd).

[2] $D_0 = PV_0 [Kd_t; CFd_t]$

The free cash flow is the hypothetical equity cash flow when the company has no debt. The expression that relates the FCF (Free Cash Flow) with the ECF is:

[3] $ECF_t = FCF_t + \Delta D_t - I_t (1 - T)$

ΔD_t is the increase in debt, and I_t is the interest paid by the company. $CFd_t = I_t - \Delta D_t$

T is the effective tax rate applied to interest.

Method 2. Using the free cash flow and the WACC (weighted average cost of capital).

Equation [4] indicates that the value of the debt (D) plus that of the shareholders' equity (E) is the present value of the expected free cash flows (FCF) that the company will generate, discounted at the weighted average cost of capital (WACC):

[4] $E_0 + D_0 = PV_0 [WACC_t ; FCF_t]$

The WACC is the rate at which the FCF must be discounted so that equation [4] gives the same result as that given by the sum of [1] and [2]. By doing so (see exhibit 1), the expression of the WACC (Weighted Average Cost of Capital) is given by [5]:

[5] $$WACC_t = \frac{E_{t-1} Ke_t + D_{t-1} Kd_t (1-T)}{E_{t-1} + D_{t-1}}$$

E_{t-1} and D_{t-1} are **not** market values nor book values: in actual fact, E_{t-1} and D_{t-1} are the values obtained when the valuation is performed using formulae [1], [2] or [4].[2]

This is explained in *"WACC: Definition, Misconceptions and Errors",* downloadable in http://ssrn.com/abstract=1620871. Also in *"Valuing Companies by Cash Flow Discounting: Ten Methods and Nine Theories",* downloadable in http://ssrn.com/abstract=256987

2. The WACC is not a cost

Just by looking at equation [5], it is clear that the WACC is neither a cost nor a required return. The WACC is a weighted average of **two very different magnitudes**:

- a cost: the cost of debt (Kd), and
- a required return: the required return to equity (Ke). Although Ke is often called "*cost of equity*", there is a big difference between a cost and a required return.

Then, the WACC is neither a cost nor a required return, but a weighted average of a cost and a required return.

To refer to the WACC as the "**cost of capital**" may be misleading because it is not a cost.

3. The WACC equation when the value of debt is not equal to its nominal value

When the required return to debt (Kd) is different from the cost of the debt (r), the value of debt (D) is not equal to its nominal value (N). The interest paid in period t is: $I_t = N_{t-1}\ r_t$.

The expression of the WACC in this case is: **[5*]** $$WACC = \frac{E\,Ke + D\,Kd - N\,r\,T}{E + D}$$

The increase in debt in period t is: $\Delta N_t = N_t - N_{t-1}$.

The debt cash flow in period t is: $CFd_t = I_t - \Delta N_t = N_{t-1}\ r_t - (N_t - N_{t-1})$.

This is explained in *"Valuing Companies by Cash Flow Discounting: Ten Methods and Nine Theories",* downloadable in http://ssrn.com/abstract=256987

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[2] Consequently, the valuation is an iterative process: the free cash flows are discounted at the WACC to calculate the company's value (D+E) but, in order to obtain the WACC, we need to know the company's value (D+E).

4. The term equity premium is used to designate four different concepts

The equity premium (also called *market risk premium, equity risk premium, market premium* and *risk premium*), is one of the most important and discussed, but elusive parameters in finance.

Part of the confusion arises from the fact that the term equity premium is used to designate four different concepts:

1. **Historical** equity premium (HEP): historical differential return of the stock market over treasuries.
2. **Expected** equity premium (EEP): expected differential return of the stock market over treasuries.
3. **Required** equity premium (REP): incremental return of a diversified portfolio (the market) over the risk-free rate required by an investor. It is used for calculating the required return to equity.
4. **Implied** equity premium (IEP): the required equity premium that arises from assuming that the market price is correct.

The equity premium designates four different concepts: Historical Equity Premium (HEP); Expected Equity Premium (EEP); Required Equity Premium (REP); and Implied Equity Premium (IEP). Although the HEP is equal for all investors, the REP, the EEP and the IEP are different for different investors.

There is a kind of schizophrenic approach to valuation: while all authors admit different expectations of equity cash flows, most authors look for a unique discount rate. It seems as if the expectations of equity cash flows are formed in a democratic regime, while the discount rate is determined in a dictatorship.

A unique IEP requires assuming homogeneous expectations for the expected growth (g), but we show that there are several pairs (IEP, g) that satisfy current prices. We claim that different investors have different REPs and that it is impossible to determine the REP for the market as a whole, because it does not exist.

"*The Equity Premium in 150 Textbooks*" (http://ssrn.com/abstract=1473225) shows that 129 out of 150 books identify Expected and Required equity premium and 82 identify Expected and Historical equity premium. This is also explained in *"Equity Premium: Historical, Expected, Required and Implied"*, downloadable in http://ssrn.com/abstract=933070

5. Textbooks differ a lot on their recommendations regarding the equity premium

"*The Equity Premium in 150 Textbooks*" reviews 150 textbooks on corporate finance and valuation published between 1979 and 2009 by authors such as Brealey, Myers, Copeland, Merton, Ross, Bruner, Bodie, Penman, Arzac, Damodaran… and shows that their recommendations regarding the equity premium range from 3% to 10%, and that 51 books use different equity premia in different pages. **Figure 1** contains the evolution of the Required Equity Premium (REP) used or recommended by 150 books and helps to explain the confusion that many students and practitioners have about the equity premium. The average is 6.5%.

Figure 1. Evolution of the Required Equity Premium (REP) used or recommended in 150 finance and valuation textbooks

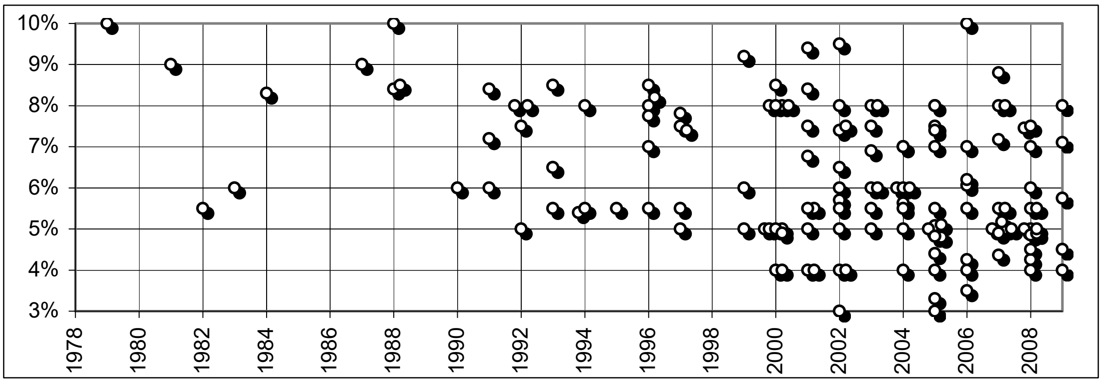
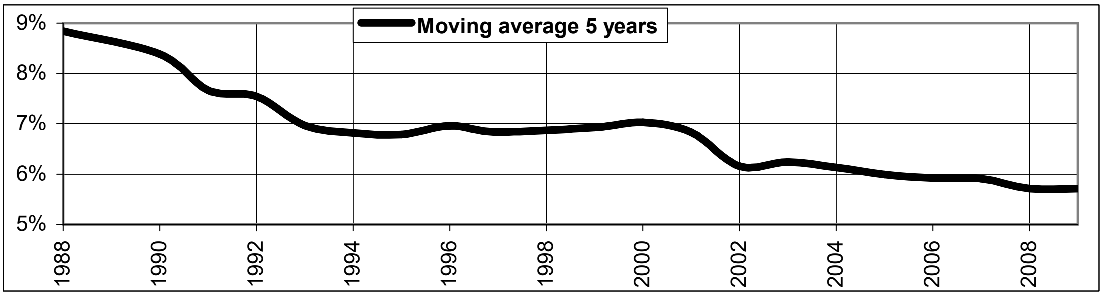


Figure 2 shows that the 5-year moving average has declined from 8.4% in 1990 to 5.7% in 2008 and 2009.

Figure 2. Moving average (last 5 years) of the REP used or recommended in 150 finance and valuation textbooks



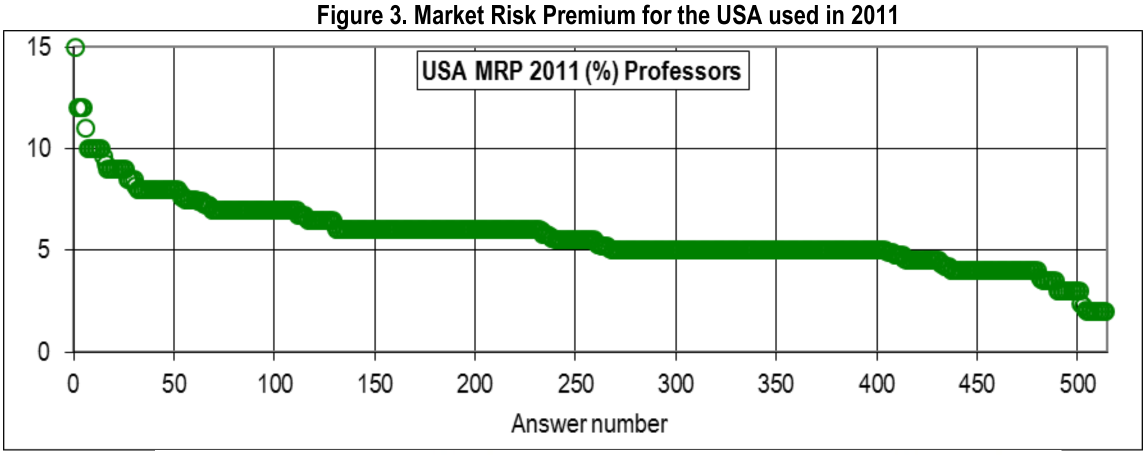
For example, **Brealey and Myers** considered until 1996 that REP = EEP = arithmetic HEP over T-Bills according to Ibbotson: 8.3% in 1984 and 8.4% in 1988, 1991 and 1996. But in 2000 and 2003, they stated that *"Brealey and Myers have no official position on the exact market risk premium, but we believe a range of 6 to 8.5% is reasonable for the United States."* In 2005, they increased that range to *"5 to 8 percent."*

Copeland *et al.* (1990 and 1995), authors of the McKinsey book on valuation, advised using a REP = geometric HEP versus Government T-Bonds, which were 6% and 5.5% respectively. However, in **2000** and **2005** they changed criteria and advised using the arithmetic[3] HEP of 2-year returns versus Government T-Bonds reduced by a survivorship bias. In 2000 they recommended 4.5-5% and in 2005 they used a REP of 4.8% because *"we believe that the market risk premium as of year-end 2003 was just under 5%."*

6. Which Equity Premium do professors, analysts and practitioners use?

A survey[4] shows that the average Market Risk Premium (MRP) used in 2011 by professors for the USA (5.7%) is higher than the one used by analysts (5.0%) and companies (5.6%). The standard deviation of the MRP used in 2011 by analysts (1.1%) is lower than the ones of companies (2.0%) and professors (1.6%). **Figure 3** shows the dispersion of the MRP used.

Figure 3. Market Risk Premium for the USA used in 2011



	Professors		Analyst		Companies	
(%)	2011	2010	2011	2010	2011	2010
Average	5,7	6.0	5,0	5.1	5,6	5.3
St. Dev.	1,6	1.7	1,1	1.1	2,0	1.8
MAX	15,0	12.0	10,0	10.0	15,0	11.2
Median	5,5	6.0	5,0	5.0	5,2	5.0
min	2,0	2.0	2,0	2.5	1,5	1.9
Number of answers	514	462	311	104	613	205

3 Although in the 2nd edition they stated (page 268) *"we use a geometric average of rates of return because arithmetic averages are biased by the measurement period."*

4 "*US Market Risk Premium Used in 2011: A Survey*", downloadable in: http://ssrn.com/abstract=1805852. Also: "*Market Risk Premium Used in 56 Countries in 2011: A Survey with 6,014 Answers*", downloadable in: http://ssrn.com/abstract=1822182

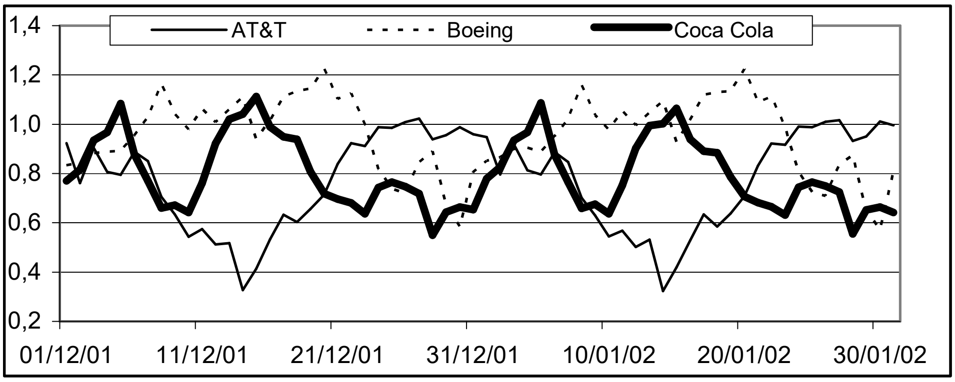
7. Calculated (historical) betas change dramatically from one day to the next

Figure 4 shows the historical betas of AT&T, Boeing and Coca-Cola in the two-month period of December 2001 and January 2002 with respect to the S&P 500. It may be seen that the beta of AT&T varies from 0.32 (January 14, 2002) to 1.02 (December 27, 2001), the beta of Boeing varies from 0.57 (January 30, 2002) to 1.22 (January 20, 2002), and the beta of Coca-Cola varies from 0.55 (December 28, 2001) to 1.11 (January 15, 2002). A closer look at the data shows that the beta of AT&T is higher than the beta of Boeing 32% of the days and is higher than the beta of Coca-Cola 50% of the days. The beta of Boeing is higher than the beta of Coca-Cola 76% of the days. AT&T has the maximum beta (of the three companies) 29% of the days and the minimum beta 47% of the days. Boeing has the maximum beta (of the three companies) 58% of the days and the minimum beta 15% of the days. Coca-Cola has the maximum beta (of the three companies) 13% of the days and the minimum beta 38% of the days.

Figure 4. Historical betas of AT&T, Boeing and Coca-Cola.

Betas calculated during the two-month period of December 2001 and January 2002 with respect to the S&P 500. Each day, betas are calculated using 5 years of monthly data, i.e. on December 18, 2001, the beta is calculated by running a regression of the 60 monthly returns of the company on the 60 monthly returns of the S&P 500. The returns of each month are calculated on the 18th of the month:

$$\text{monthly return of December 18, 2001} = \frac{\text{total return December 18, 2001}}{\text{total return November 18, 2001}} - 1$$



This is explained in "*Are Calculated Betas Worth for Anything*?", downloadable in http://ssrn.com/abstract=504565

The article provides additional information about the 62 calculated betas of 3,813 companies with respect to the S&P 500 in the two -month period of December 2001 and January 2002:

2,927 companies (77%) had, in the sample period, a maximum beta more than two times bigger than their minimum beta.

Only 2,780 companies (73%) had positive betas on the 62 consecutive days.

52% of companies in the S&P 500 had a maximum beta more than two times bigger than their minimum beta.

The median of the difference between the maximum and the minimum of the 62 betas calculated for each company was 0.88 for the 3,813 companies in our full sample, 0.63 for the 450 companies in the S&P 500,

Looking at industry betas, 25% of the industries had a maximum beta more than two times bigger than their minimum beta.

It seems that it can be an enormous error to use the historical beta as a proxy for the expected beta. First, because it is almost impossible to calculate a meaningful beta because historical betas change dramatically from one day to the next. Second, because very often we cannot say with a relevant statistical confidence that the beta of one company is smaller or bigger than the beta of another. Third, because historical betas do not make much sense in many cases: high-risk companies very often have smaller historical betas than low-risk companies. Fourth, because historical betas depend very much on which index we use to calculate them.

8. Why do many professors still use calculated (historical) betas in class?

A survey[5] done in 2009 reports 2,510 answers from professors from 65 countries and 934 institutions. 1,791 respondents use betas, but 107 of them do not justify the betas they use.

97.3% of the professors that justify the betas use regressions, webs, databases, textbooks or papers (the paper specifies which ones), although many of them state that calculated betas *"are poorly measured and have many problems".*

Only 0.9% of the professors justify the beta using exclusively personal judgement (named qualitative, common sense, intuitive, and logical magnitude betas by different professors).

All professors admit that different investors may have different expected cash flows, but many of us affirm that the required return should be equal for everybody: That is a kind of schizophrenic approach to valuation. Most professors teach that the expected cash flows should be computed using common sense and good judgement about the company, its industry, the national economies… However, many professors teach a formula to calculate the discount rate (instead of using again common sense).

The paper includes interesting comments such as:

- *I justify the betas by computing them and proving that they are right. References are also made to financial webs.*
- *I always emphasize that beta calculations have to be taken with some leeway.*
- *I use betas… but I use all metrics that are available.*
- *I do not have much confidence in beta, but we don't seem to have any easy substitute.*
- *It is poorly measured, but no substitution so far.*
- *I justify the betas if the published betas are "abnormal" (i.e., negative when you would expect it to be positive)*
- *The model has received a Nobel Prize in Economics and while not perfect is used extensively in practice.*
- *If you don't use betas, how do you adjust for risk? Almost every practitioner book uses betas such as the McKinsey publications.*
- *I use whatever is suggested in the teaching note.*
- *Beta is a simple method and it is used in the "real world." It is really not so helpful, although easy to use.*
- *I use beta in my valuations. In consulting, it is essential to fully support your estimates.*
- *Referees want to see them as the underlying model. I need a model anyway, and these are the safe bets that referees will not challenge.*
- *Students tend so see CAPM as just one recipe from a cooking book.*
- *I do not use betas except for teaching purposes. I researched the predictability for stock returns. I found worse out of sample predictive power for future returns using betas than when the market average return is used.*
- *We justify use of betas through underlying theory and students get convinced. I found that students are quite excited about betas.*

9. EVA does not measure Shareholder value creation[6]

EVA™ (*economic value added*) is the term used[7] to define:

$$\mathbf{EVA_t = NOPAT_t - (D_{t-1} + Ebv_{t-1})\ WACC}$$

EVA is simply the NOPAT less the firm's book value ($D_{t-1} + Ebv_{t-1}$) multiplied by the average cost of capital (WACC). NOPAT (*net operating profit after taxes*) is the profit of the unlevered (debt-free) firm. Sometimes, it is also called EBIAT (earnings before interest and after tax)[8].

Stern Stewart & Co's advertising contained such eye-catching statements as the following:

- *"EVA is the measure that correctly takes into account value creation or destruction in a company".*
- *"EVA is a measure of the true financial performance of a company".*
- *"There is evidence that increasing EVA is the key for increasing the company's value creation".*
- *"more EVA always is unambiguously better for shareholders".*
- *"managing for higher EVA is, by definition, managing for a higher stock price".*

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[5] "*Betas Used by Professors: A Survey with 2,500 Answers*", http://ssrn.com/abstract=1407464

[6] This is explained in *"EVA and Cash Value Added Do Not Measure Shareholder Value Creation"*, http://ssrn.com/abstract=270799

[7] According to Stern Stewart & Co's definition (page 192 of their book *The Quest for Value. The EVA Management Guide)*

[8] NOPAT is also called NOPLAT (Net Operating Profit Less Adjusted Taxes).

- *"EVA is the performance measure most directly linked to the creation of shareholder wealth over time".*

However, accounting-based measures cannot measure value creation

The change in the firm's value over a certain period is basically determined by the changes in expectations regarding the growth of the firm's cash flows and also by the changes in the firm's risk, which lead to changes in the discount rate. However, accounting only reflects the firm's history. Both the items of the income statement, which explain what has happened during a certain year, and those of the balance sheet, which reflect the state of a firm's assets and liabilities at a certain point in time, are historic data. Consequently, it is impossible for accounting-based measures, such as EVA, to measure value creation.

It is simple to verify this statement in quantitative terms: one has only to analyze the relationship between the shareholder value creation, or the shareholder value added, and the EVA and cash value added.

Using EVA, MVA, NOPAT and WACC data provided by Stern Stewart for 582 companies, it is easy to calculate the 10-year correlation between the increase in the MVA (Market Value Added) each year and each year's EVA, NOPAT and WACC:

- For 210 companies (out of the 582) the correlation with the EVA was negative!
- The average correlation between the increase in the MVA and EVA, NOPAT and WACC was 16%, 21% and -21.4%.
- The average correlation between the increase in the MVA and the increases of EVA, NOPAT and WACC was 18%, 22.5% and -4.1%.

10. The relationship between the WACC and the value of the tax shields (VTS) [9]

The correct calculation of the WACC rests on a correct valuation of the tax shields. The value of tax shields depends on the debt policy of the company.

The equation that relates the WACC and the VTS (the Value of Tax Shields) for a perpetuity (being g the growth rate) is: $WACC = Ku\left(1 - \frac{VTS}{E+D}\right) + \frac{g\,VTS}{E+D}$

And the relationship between Ke and Ku is: $Ke = Ku + \frac{D}{E}\left[Ku - Kd(1-T)\right] - \frac{VTS}{E}\left(Ku - g\right)$

Ke is the required return to equity, Kd is the cost of the debt,
Ku is the required return to equity in the debt-free company (also called the required return to assets)
T is the effective tax rate applied to earnings. D is the value of the debt and E is the value of the equity.

11. Beta and CAPM do not explain anything about expected or required returns

There are mountains of evidence to that CAPM and its Betas do not explain anything about expected or required returns.

It is necessary (though not sufficient) to differentiate between a **fact** *(something that truly exists or happens)* and an **opinion** *(what someone thinks about a particular thing).* It is a fact that Beta and CAPM do not explain anything about expected or required returns. CAPM may be considered as a useless and absurd model (opinion)[10].

12. Difference between the expected and the required rates of return

I have never estimated an expected rate of return (I do not know how to do it), but I have helped several companies and investors to estimate required returns. The document "*Expected and Required returns: very different concepts*" (http://ssrn.com/abstract=2591319) shows that they are very different

[9] This is explained in *"A General Formula for the WACC: A Correction"*, http://ssrn.com/abstract=949464

[10] This is explained in *"CAPM: an absurd model"* http://ssrn.com/abstract=2505597. Also in "Is it Ethical to Teach that Beta and CAPM Explain Something?", https://ssrn.com/abstract=2980847.

concepts for the majority of investors[11]. Confusing those leads to many mistakes and wrong decisions. CAPM is about expected returns.

Box 1 has a very instructive anecdote from Merton Miller (Nobel Prize winner in 1990) about the CAPM. Miller says that the most important measure in *financial economics* is the *expected rate of return*. However, many financial managers of banks and companies, professors (and myself) have never calculated an expected rate of return.

Box 1. Miller, M. (2000, p. 3): *"I still remember the teasing we financial economists, Harry Markowitz, William Sharpe, and I, had to put up with from the physicists and chemists in Stockholm when we conceded that the basic unit of our research, the **expected rate of return**, was not actually observable. I tried to tease back by reminding them of their neutrino—a particle with no mass whose presence was inferred only as a missing residual from the interactions of other particles. But that was eight years ago. In the meantime, the neutrino has been detected".*

13. It has been very easy to beat the S&P500 in 2000-2018

The paper "*It Has Been Very Easy to Beat the S&P500 in 2000-2018: Several Examples*" (https://ssrn.com/abstract=3184501) documents that unweighted indexes have outperformed weighted indexes and that the S&P400 and the S&P600 have outperformed the S&P500 in 2000-2018. Using Kenneth French data for the period 1927-2018 the paper also shows that it has been so since 1927.

14. Apply the logic principle *"Never buy a hair growth lotion from a man with no hair"* to your investment advisors… and to your professors

If you find a formula (or model, recipe…) for calculating expected returns that works reasonably well in the real markets, would you publish it? Before or after being billionaire?

The author of the prediction (the model that helps to predict the future, the investment recommendation…) is he a billionaire?

15. Rational investing in equities

We know just a few things about rational investing in equities. Among them:

a) Diversification is a must
b) A portfolio of small (market-cap) companies has outperformed long-term a portfolio of big companies
c) Unweighted indexes have outperformed weighted indexes
d) Rational investors evaluate the managerial and ethical behavior of the companies in which they invest
e) Rational investors avoid investing in expensive (according to their judgement) companies

16. Volatility is a bad measure of risk.

If risk is something bad for all investors, then volatility is not risk because many investors (including the author) like volatility. What most equity investors do not like is bankruptcy, default… in their investments. A portfolio 'mean-variance efficient' is good for nothing because the variance (or volatility) is not an appropriate measure of investment risk.

17. About the unhelpfulness of the Sharpe ratio.

As the volatility is not an appropriate measure of investment risk (in fact, many investors like volatility), the Sharpe ratio (return / volatility) cannot be a good measure for anything. I asked to 137 graduate students the following question: *"For the following 10 years, do you prefer an investment with an annual return of 16% and a Sharpe ratio of 0,4 or another investment with an annual return of 13% and a Sharpe ratio of 1,3?"* All of them (the 137 graduate students) preferred the first investment. And you?

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[11] *"There are many valuations that assume that the expected return is equal to the required return. They are two very different concepts, although many books and financial literature do not distinguish them. The topic of this short paper is "thinking about valuation: it is important to understand what we are doing."*

18. Common errors in portfolio management and wrong advices

1 Diversify the holding of risky assets according to the proportions of the market portfolio.
2 The only risk that matters is volatility.
3 The only risk that matters is beta.
4 Markets are efficient all the time.
5 The Sharpe ratio is useful.
6 Higher return means necessarily to assume higher risk.
7 Market indexes are difficult/impossible to beat.

Exhibit 1. Calculating the WACC

The intertemporal form of equations [1], [2] and [4] is:

[1i] $E_{t+1} = E_t (1+Ke_{t+1}) - ECF_{t+1}$ [2i] $D_{t+1} = D_t (1+Kd_{t+1}) - CFd_{t+1}$

[4i] $[E_{t+1} + D_{t+1}] = [E_t + D_t] (1+WACC_{t+1}) - FCF_{t+1}$

The sum of [1i] and [2i] must be equal to [4i]:

$$[E_t + D_t] + E_t Ke_{t+1} + D_t Kd_{t+1} - [ECF_{t+1} + CFd_{t+1}] = [E_t + D_t] (1+WACC_{t+1}) - FCF_{t+1}$$

As $CFd_{t+1} = D_t Kd_{t+1} - [D_{t+1} - D_t]$ and $ECF_{t+1} = FCF_{t+1} + [D_{t+1} - D_t] - D_t Kd_{t+1} (1-T)$

$$[ECF_{t+1} + CFd_{t+1}] = FCF_{t+1} + D_t Kd_{t+1} -- D_t Kd_{t+1} (1-T) \quad \text{and}$$

$$[E_t + D_t] + E_t Ke_{t+1} + D_t Kd_{t+1} (1-T)] - FCF_{t+1} = [E_t + D_t] (1+WACC_{t+1}) - FCF_{t+1}$$

$[E_t + D_t] WACC_{t+1} = E_t Ke_{t+1} + D_t Kd_{t+1} (1-T)$. The WACC is: $\boxed{WACC_{t+1} = \frac{E_t Ke_{t+1} + D_t Kd_{t+1}(1-T)}{E_t + D_t}}$

T is the effective tax rate applied to interest in equation [3]. $E_t + D_t$ are **not** market values nor book values: in actual fact, E_t and D_t are the values obtained when the valuation is performed using formulae [1], [2] or [4].

Exhibit 2. Capital Asset Pricing Model (CAPM)

The CAPM came about when answering the following question: What equity and bond portfolio should an investor who has risk aversion form? Risk aversion means: given equal expected return, an investor will always prefer a lower-risk portfolio. But risk is measured as volatility (σ) or variance (σ^2). To define risk as volatility is an **absurd assumption**. Just talk to wise investors to realize that there are many who like volatility. What investors do not like is bankruptcy or suspension of payments (unless they have a "short" position).

a) An investor wishes to form an optimal portfolio. By optimal portfolio we mean that which has the lowest risk for a given expected return (the measure of the risk is the variance of the portfolio return). The investor forms a portfolio with N securities. The expected return of each security in the following period is R_i and the weight of each security in the portfolio is W_i. The sum of each security's weights in the portfolio is unity: $\sum_{i=1}^{N} W_i = 1$ [1]

The portfolio's expected return, $E(R_c)$, and the expected variance of the portfolio return, $Var(R_c)$, are:

$$E(R_c) = \sum_{i=1}^{N} W_i \, E(R_i) \quad [2] \qquad Var(R_c) = \sigma_c^2 = \sum_{i=1}^{N} \sum_{j=1}^{N} Cov(R_i, R_j) W_i W_j \quad [3]$$

σ_c is the portfolio's expected volatility. Cov (R_i, R_j) is the covariance of the expected return of company i with the expected return of company j. We want to find the weight of each share (W_i) which minimizes the expected variance of the portfolio return, for a given expected return R. Consequently, we have to solve:

$$\text{Min } \sigma_c^2 \quad \text{with conditions:} \quad E(R_c) = R \text{ ; and } \sum_{i=1}^{N} W_i = 1 \qquad [4]$$

For each expected return, there will be a different portfolio with a minimum variance. This portfolio is usually called the *efficient portfolio*. These efficient portfolios, taken together, form the **efficient frontier (EF).**
This problem is solved by minimizing the following Lagrange equation:

$$\text{Lagrange} = \sigma_c^2 + \lambda (R_c - R) + \phi \left(\sum_{i=1}^{N} W_i - 1 \right) \qquad [5]$$

To minimize, the Lagrange equation is derived with respect to $W_1, W_2, \ldots W_N$ and is made equal to zero for each of the N derivatives. Derivative with respect to W_i: $\frac{\partial \sigma_c^2}{\partial W_i} + \lambda \frac{\partial R_c^2}{\partial W_i} + \phi = 0$ We can simplify these expressions because:

$$\frac{\partial R_c}{\partial W_i} = E(R_i) \quad \text{and} \quad \frac{\partial \sigma_c^2}{\partial W_i} = \sum_{j=1}^{N} W_j \, Cov(R_i, R_j) = Cov(R_i, \sum_{j=1}^{N} W_j \, R_j) = Cov(R_i, R_c)$$

Consequently, the derivatives become: $Cov(R_i, R_C) + \lambda E(R_i) + \varnothing = 0$; $i = 1, 2, \ldots, N$ [6]

If one of the securities is a risk-free bond, with a yield $R_i = R_F$, its covariance with the portfolio is zero: $Cov(R_F, R_C) = 0$.

Equation [6] for the risk-free bond becomes: $\lambda R_F + \varnothing = 0$ [7]

The partial derivative also must be applicable to the portfolio c as a whole. In this case, $R_i = R_c$; $Cov(R_C, R_C) = Var(R_C)$

Consequently: $Var(R_C) + \lambda E(R_C) + \varnothing = 0$; as $\varnothing = -\lambda R_F$: $Var(R_C) = -\lambda (R_C - R_F)$

The parameters λ and $\varnothing$ are: $\lambda = - Var(R_C) / [E(R_C) - R_F]$; $\varnothing = R_F Var(R_C) / [E(R_C) - R_F]$ [8]

Substituting λ and $\varnothing$: $Cov(R_i, R_c) - \frac{Var(R_c)}{E(R_c) - R_F} E(R_i) + \frac{Var(R_c)}{E(R_c) - R_F} R_F = 0.$ $i = 1, 2, \ldots, N$

Isolating the expected return for the share i gives:

$E(R_i) = R_F + \frac{Cov(R_i, R_c)}{Var(R_c)} [E(R_c) - R_F]$. $i = 1, 2, \ldots, N.$ If we call $\beta_i = \frac{Cov(R_i, R_c)}{Var(R_c)}$, this gives:

$\mathbf{R_i = R_F + \beta_i (R_c - R_F).}$ $i = 1, 2, \ldots, N.$ [9]

It is important to stress that R_i, $Cov(R_i, R_j)$ and $Var(R_i)$ are our investor's expectations for the next period (which may be one year, one month,...).

b. Optimal portfolio if all investors have homogeneous expectations. If all investors have the same time horizon and also identical return and risk expectations (volatility of each share and correlation with the other shares) for all shares[12], then the investors will have the same portfolio and this is the **market portfolio M** (composed of all the shares on the market). If $E(R_M)$ is the market return expected by all investors (because they all have the same expectations):

$\mathbf{E(R_i) = R_F + \beta_i [E(R_M) - R_F]}$ $i = 1, 2, \ldots$ [10]

This is the expression of the ***Capital Asset Pricing Model* (CAPM). [E(R_M) - R_F] is called Market Risk Premium (MRP), Equity Premium (EP), Equity Risk Premium (ERP) … (all expected)**

In equilibrium, the investors will have shares in all companies and the portfolio c will be the stock market. All investors will have a portfolio composed of risk-free assets and the diversified portfolio, which is the market. The equation of the line called *capital market line* (CML) is: $\mathbf{E(R_i) = R_F + [(E(R_M) - R_F) / \sigma_M] \sigma_i}$

Thus, according to the CAPM, the required return to an asset will be equal to its expected return and will be equal to the risk-free rate plus the asset's beta multiplied by the required market return above the risk-free rate.

Basic assumptions on which the CAPM is based. All investors:
a. have homogeneous expectations (same expected return, volatility and correlations for every security),
b. can lend and borrow unlimited amounts at the risk-free rate of interest R_F,
c. can short any asset, and hold any fraction of an asset,
d. plan to invest over the same time horizon.
e. investors are risk-averse and only care about the expected return and the volatility of their investments[13]

Main predictions of the CAPM. The CAPM assumptions imply that all investors:
a. will always combine a risk free asset with the market portfolio (the proportions will vary depending on their utility function),
b. will have the same portfolio of risky assets (the market portfolio)[14],
c. agree on the expected return and on the expected variance of the market portfolio and of every asset,
d. agree on the expected MRP and on the beta of every asset,
d. agree on the market portfolio being on the minimum variance frontier and being mean-variance efficient,
e. expect returns from their investments according to the betas.

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[12] The **most extravagant and absurd hypothesis**: all investors have **homogeneous expectations** for each of the stocks, bonds ... (all investors expect the same return and the same volatility for each of the stocks).

[13] Other assumptions are: no transaction costs (no taxes, no commissions…); all information is available at the same time to all investors; each investor is rational and risk-averse, and wants to maximize his expected utility.

[14] Very risk-averse investors will put most of their wealth in risk-free asset, while risk-tolerant investors will put most of their wealth in the market portfolio.

As there are homogeneous expectations, constant utility functions and there is no disagreement about the price or the value of any security:
f. trading volume of financial markets will be very small.

When the "homogeneous expectations" assumption is not met, the market M will no longer be the efficient portfolio for all investors. Investors with different expectations will have different portfolios (each one having the portfolio he considers most efficient), instead of the market portfolio M.

Formulas for calculating the beta. A share's historical beta can be calculated by means of any of the following formulas:
β = Covariance (R_i , R_M) / Variance (R_M) = Correlation (R_i , R_M) x Volatility (R_i) / Volatility (R_M)

$$\beta_i = Cov\ (R_i\ ,\ R_M)\ /\ \sigma_M^2 = Corr\ \ (R_i\ ,\ R_M)\ \sigma_i\ /\ \sigma_M$$

where: R_i = security return; R_M = market return

Other Relationships: $R = Corr\ (R_i , R_M) = Cov\ (R_i , R_M) / (\sigma_M\ \sigma_i) = \beta_i\ \sigma_M / \sigma_i$

$R^2 = 1 - \sigma_\varepsilon^2 / \sigma_i^2$ $\quad\sigma_\varepsilon^2 = \sigma_i^2 - \beta_i^2\ \sigma_M^2 = \sigma_i^2 - R^2\ \sigma_i^2 = \sigma_i^2\ (1 - R^2)$

To calculate a share's beta, a regression is normally performed between the share's return (R_i) and the market return (R_M). The share's beta (β_i) is the slope of the regression: $R_i = a + \beta_i\ R_M + \varepsilon$ $\quad\varepsilon$ is the error of the regression.

Relationship between beta and volatility (σ): $\quad\sigma_i^2 = \beta_i^2\ \sigma_M^2 + \sigma_\varepsilon^2$

σ_i is the volatility of the return R_i. ($\beta_i\ \sigma_M$) is the non-diversifiable risk and (σ_ε) is the non-systematic or diversifiable risk

Exhibit 2. Some papers about the CAPM

A huge amount of papers have been written about the CAPM. We review some of them.

The CAPM of Sharpe (1964), Lintner (1965) and Mossin (1966) asserts that the expected return for any security is a function of three variables: expected beta, expected market return, and the risk-free rate. Sharpe (1964) and Lintner (1965) demonstrate that, with some senseless assumptions, a financial asset's return must be positively linearly related to its beta (β): $E(R_i) = a_1 + a_2\ E(\beta_i)$, for all assets i. $E(R_i)$ is the expected return on asset i, $E(\beta_i)$ is asset i's expected market beta, a_1 is the expected return on a "zero-beta" portfolio, and a_2 is the market risk premium: $E(R_M) - R_F$

Original tests of the CAPM focused on whether the intercept in a cross-sectional regression was higher or lower than the risk-free rate, and whether stock individual variance entered into cross-sectional regressions.

Miller and Scholes (1972) report that the sample average of the standard error of the beta estimates of all NYSE firms is around 0.32, as compared to the average estimated beta coefficient of 1.00. Thus, a random draw from this distribution of betas is going to produce any number between 0.36 and 1.64 ninety-five percent of the time. It is this imprecision in individual beta estimates (or the better known "*errors in variables*" problem) that motivated portfolio formation techniques of Black, Jensen, and Scholes (1972) and Fama and MacBeth (1973).

Scholes and Williams (1977) found that with nonsynchronous trading of securities, OLS estimators of beta coefficients using daily data are both biased and inconsistent.

Subsequent work by (among many others) Basu (1977), Banz (1981), Reinganum (1981), Gibbons (1982), Litzenberger and Ramaswamy (1979), Keim (1983, 1985)[15] and Fama and French (1992) suggests that either:

- expected returns are determined not only by the beta and the expected market risk premium but also by other firm characteristics such as price-to-book value ratio (P/B), firm size, price-earnings ratio and dividend yield (it means that the CAPM requires the addition of factors other than beta to explain security returns), or
- the historical beta has little (or nothing) to do with the expected beta and the historical market risk premium has little (or nothing) to do with the expected market risk premium, or
- the heterogeneity of expectations[16] in cross-section returns, volatilities and covariances, and market returns is the reason why it makes no sense to talk about an aggregate market CAPM (although at the individual level expected CAPM could

[15] Basu (1977) found that low price/earnings portfolios have higher returns than could be explained by the CAPM. Banz (1981) and Reinganum (1981) found that smaller firms tend to have high abnormal rates of return. Litzenberger and Ramaswamy (1979) found that the market requires higher rates of return on equities with high dividend yield. Keim (1983, 1985) reports the January effect, that is, seasonality in stock returns. Tiniç and West (1984) reject the validity of the CAPM based on intertemporal inconsistencies due to the January effect.

[16] Lintner (1969) argued that the existence of heterogeneous expectations does not critically alter the CAPM in some simplified scenarios and said that "*in the (undoubtedly more realistic) case with different assessments of covariance matrices, the market's assessment of the expected ending price … for any security depends on every investor's assessment of the expected ending price for every security and every element in the investor's assessment of his NxN covariance matrix (N is the number of securities), as well as the risk tolerance of every investor.*"

work). Each investor uses an expected beta, an expected market risk premium, and an expected cash flow stream to value each security, and investors do not agree on these three magnitudes for each security.

Roll (1977) concluded that the only legitimate test of the CAPM is whether or not the market portfolio (all assets) is mean-variance efficient. Roll (1981) suggests that infrequent trading of shares of small firms may explain much of the measurement error in estimating their betas.

Constantinides (1982) points out that with consumer heterogeneity *"in the intertemporal extension of the Sharpe-Lintner CAPM, an asset's risk premium is determined not only by its covariance with the market return, but also by its covariance with the m − 1 state variables"* (m is the number of heterogeneous consumers). He also points out that the assumption of complete markets is needed for demand aggregation.

Lakonishok and Shapiro (1984, 1986) find an insignificant relationship between beta and returns and a significant relationship between market capitalization and returns

Shanken (1992) presents an integrated econometric view of maximum-likelihood methods and two-pass approaches to estimating historical betas.

The poor performance of the CAPM has inspired multiple portfolio based factors. The hardest blow to the CAPM was published by Fama and French (1992): they showed that in the period 1963-1990, the correlation between stocks' returns and their betas was very small, while the correlation with the companies' size and their (P/B) was greater. They concluded *"our tests do not support the most basic prediction of the Sharpe-Lintner-Black CAPM that average stock returns are positively related to market betas".* The authors divided the shares into portfolios and found that the cross-sectional variation in expected returns may be captured within a three-factor model, the factors being: 1) the return on the market portfolio in excess of the risk-free rate; 2) a zero net investment portfolio that is long in low P/B stocks and short in high P/B stocks, and 3) a zero net investment portfolio that is long in small firm stocks and short in large firm stocks. The following table shows the article's main findings.

Main findings of Fama and French's article (1992)

Size of the companies	Average beta	Annual average return	**Beta** of the companies	Average beta	Annual average return	**P/B** Price / book value	Average beta	Annual average return
1 (biggest)	0.93	10.7%	1 (high)	1.68	15.1%	1 (high)	1.35	5.9%
2	1.02	11.4%	2	1.52	16.0%	2	1.32	10.4%
3	1.08	13.2%	3	1.41	14.8%	3	1.30	11.6%
4	1.16	12.8%	4	1.32	14.8%	4	1.28	12.5%
5	1.22	14.0%	5	1.26	15.6%	5	1.27	14.0%
6	1.24	15.5%	6	1.19	15.6%	6	1.27	15.6%
7	1.33	15.0%	7	1.13	15.7%	7	1.27	17.3%
8	1.34	14.9%	8	1.04	15.1%	8	1.27	18.0%
9	1.39	15.5%	9	0.92	15.8%	9	1.29	19.1%
10 (smallest)	1.44	18.2%	10 (low)	0.80	14.4%	10 (low)	1.34	22.6%

The next table contains the main differences between the "CAPM world" and the real world

CAPM	**Real world**
Homogeneous expectations All investors have equal expectations about asset returns	**Heterogeneous** expectations. Investors DO NOT have equal expectations about asset returns
Investors only care about expected return and volatility of their investments	Investors also care about jumps, crashes and bankruptcies
All investors use the same beta for each share	Investors use **different** betas (required betas) for a share
All investors hold the market portfolio	Investors hold **different** portfolios
All investors have the same expected market risk premium	Investors have **different** expected market risk *premia* and use **different** required market risk *premia*

Roll and Ross (1994) attribute the observed lack of a systematic relation between risk and return to the possible mean-variance inefficiency of the market portfolio proxies.

Lakonishok, Shleifer and Vishny (1994) argue that the size and P/B effects are due to investor overreaction rather than compensation for risk bearing. According to them, investors systematically overreact to corporate news, unrealistically extrapolating high or low growth into the future. This leads to underpricing of "value" (small capitalization, high P/B stocks) and overpricing of "growth" (large capitalization, low P/B stocks).

Kothary, Shanken and Sloan (1995) point out that using historical betas estimated from annual rather than monthly returns produces a stronger relation between return and beta. They also claim that the relation between P/B and return observed by Fama and French (1992) and others is exaggerated by *survivor bias* in the sample used and conclude: *"our examination of the cross-section of expected returns reveals economically and statistically significant compensation (about 6 to 9% per annum) for beta risk".*

Pettengill, Sundaram and Mathur (1995) find *"a consistent and highly significant relationship between beta and cross-sectional portfolio returns".* They insist: *"the positive relationship between returns and beta predicted by CAPM is based on expected rather than realized returns".* They remark that their results are similar to those of Lakonishok and Shapiro (1984)

Fama and French (1996) argue that survivor bias does not explain the relation between P/B and average return. They conclude that historical beta alone cannot explain expected return.

Kothary and Shanken (1999) insist on the fact that Fama and French (1992) tend to ignore the positive evidence on historical beta and to overemphasize the importance of P/B. They claim that, while statistically significant, the incremental benefit of size given beta is surprisingly small. They also claim that P/B is a weak determinant of the cross-sectional variation in average returns among large firms and it fails to account for return differences related to momentum and trading volume.

Berglund and Knif (1999) propose an adjustment of the cross-sectional regressions of excess returns against betas to give larger weights to more reliable beta forecasts. They find a significant positive relationship between returns and the beta forecast when the proposed approach is applied to data from the Helsinki Stock Exchange, while the traditional Fama-MacBeth (1973) approach as such finds no relationship at all.

Elsas, El-Shaer and Theissen (2000) "*find a positive and statistically significant relation between beta and return in our sample period 1960-1995 as well as in all subperiods we analyze"* for the German market. They claim, *"Our empirical results provide a justification for the use of betas estimated from historical return data by portfolio managers".*

Cremers (2001) claims that the data do not give clear evidence against the CAPM because it is difficult to reject the joint hypothesis that the CAPM holds and that the CRSP value-weighted index is efficient or a perfect proxy for the market portfolio. He also claims that the poor performance of the CAPM seems often due to measurement problems of the market portfolio and its beta. He concludes that *"according to the data, the CAPM may still be alive".*

Bartholdy and Peare (2001) argue that five years of monthly data and an equal-weighted index provide the most efficient estimate of the historical beta. However, they find that the ability of historical betas "to explain differences in returns in subsequent periods ranges from a low of 0.01% to a high of 11.73% across years, and at best 3% on average". Based on these results, they say *"it may well be appropriate to declare beta dead".*

Chung, Johnson and Schill (2001) use size-sorted portfolio returns at daily, weekly, quarterly and semi-annual intervals and find in every case that the distribution of returns differs significantly from normality. They also show that adding systematic co-moments (not standard) of order 3 through 10 reduces the explanatory power of the Fama-French factors to insignificance in almost every case.

Zhang, Kogan, and Gomes (2001) claim that *"size and book-to-market [B/P] play separate roles in describing the cross-section of returns. These firm characteristics appear to predict stock returns because they are correlated with the true conditional market beta of returns."* Avramov and Chordia (2001) test whether the Zhang, Kogan, and Gomes (2001) scaling procedure improves the performance of the CAPM and consumption CAPM. They show that equity characteristics often enter beta significantly. However, "*characteristic scaled factor models*" do not outperform their unscaled counterparts.

Shalit and Yitzhaki (2002) argue that the OLS regression estimator is inappropriate for estimating betas. They suggest alternative estimators for beta. They eliminate the highest four and the lowest four market returns and show that the betas of 75% of the firms change by more than one standard error.

Avramov (2002) shows that small-cap value stocks appear more predictable than large-cap growth stocks, and that model uncertainty is more important than estimation risk: investors who discard model uncertainty face large utility losses.

Griffin (2002) concludes that country-specific three-factor models are more useful in explaining stock returns than are world and international versions.

Koutmos and Knif (2002) propose a dynamic vector GARCH model for the estimation of time-varying betas. They find that in 50% of the cases betas are higher during market declines (the opposite is true for the remaining 50%). They claim that the static market model overstates unsystematic risk by more than 10% and that dynamic betas follow stationary, mean reverting processes.

McNulty et al. (2002), say that "*although Apple's stock was almost twice as volatile as IBM's during the five years (1993-1998) we looked at (52% volatility for Apple; 28% for IBM), its correlation with the market's movement was only one-fourth as great (0.105 for Apple; 0.425 for IBM)… resulting in a beta of 0.47 for Apple compared with 1.09 for IBM".* They also point out that for a *"UK-based multinational, a two-day shift in the sampling day (using Friday's stock prices rather than Wednesday's) to calculate beta, generated quite different betas of 0.70 and 1.41."*

Fama and French (2004) affirm that "*the failure of the CAPM in empirical tests implies that most applications of the model are invalid*".

Merrill Lynch and Bloomberg adjust betas in a very simple way: Expected beta = 0.67 historical beta + 0.33. Of course, this "Expected beta" works better than the "historical beta" because "*β = 1 does a better job than calculated betas*"[17].

Thompson *et al*. (2006), in their paper "Nobels for Nonsense", show evidences against Markowitz and the CAPM: a) the correlation between the return and the volatility of the Ibbotson Index in 1926-2000 was negative (-0.32); b) 65% of the portfolios chosen randomly had a higher return than the CAPM could predict; c) an "equal weight index" had in 1970-2002 an annualized return 4.8% higher than the S&P 500. They conclude that *"the use of flawed models by true believers can cause mischief not only for individual investors but also for the economy generally".*

Bossaerts, Plott. and Zame (2007) suggest a new approach to asset pricing and portfolio choices based on unobserved heterogeneity and offer a novel econometric procedure to test their novel model (they name it CAPM+ε). Then, they apply the econometric tests to data generated by **large-scale laboratory asset markets** and they claim that CAPM+ε is not rejected. OK in a laboratory, but in the real financial markets?

Aktas and McDaniel (2009) show cases *"where CAPM-generated costs of equity are less than zero; less than the risk-free rate and less than the company's marginal cost of debt".* They calculate betas using 60 and 120-monthly returns. They also refer to a COMPUSTAT file with *"8361 total companies with listed betas. Totally 925 of these are negative".*

Magni (2009, 2010) explains the incorrectness of the CAPM and its development. He also points out that Dybvig and Ingersoll (1982) were the first that noticed that CAPM is at odds with arbitrage pricing.

Shalit and Yitzhaki (2010) argue (with theoretical papers) that the only problem of CAPM is relying on the Normal distribution.

Levy and Roll (2010), with a provocative title (The Market Portfolio May Be Mean/Variance Efficient after All) affirm that "*many conventional market proxies could be perfectly consistent with the CAPM and useful for estimating expected returns… if one allows for only slight estimation errors in the return moments".* They call this data-massage "*a reverse-engineering approach": "we find the minimal variations in sample parameters required to ensure that the proxy is mean/variance efficient."* This paper is an example of "***using the hammer to fit the data into a model*";** its graphic representation are the 2 charts in page 2486 about which the authors surprisingly say that "*sample betas are quite close to betas that have been adjusted*". Levy and Roll (2010) is an experiment because they use monthly returns of only the 100 biggest US companies in the period Dec. 1996- Dec. 2006 (in that period the average returns of all companies were positive). They work with historical returns but claim to prove or disprove something for the CAPM that deals with expected returns.

Brennan and Lo (2010) designate an efficient frontier as "i*mpossible*" when every efficient portfolio has at least one negative weight. They prove that the probability of an impossible frontier approaches 1 as the number of assets increases and with sample parameters. Levy and Roll (2011) refer to Brennan and Lo (2010) and admit that "*sample parameters lead to an impossible frontier"… "But a slight modification of the parameters leads to a segment of positive portfolios on the frontier".*

Levy (2011) argues that although behavioral economics contradicts aspects of expected utility theory, CAPM and M-V (mean-variance rule) are intact in both expected utility theory and cumulative prospect theory frameworks. He says that there is furthermore no evidence to reject CAPM empirically when ex-ante parameters are employed. De Giorgi, Hens and Levy (2012) conclude (in an only-theoretical paper) that *"the CAPM is intact also in CPT (Cumulative Prospect Theory) framework".*

Giannakopoulos (2013) finds that *"regarding the Levy/Roll (2010) approach, the results for the optimizations are very sensitive to the choice of the portfolio used, the market returns and standard deviation, as well as to the choice of the risk free rate… it is possible to manipulate these results, up to a certain point… in order to accomplish a better outcome and improve the robustness of the model".* And also that when we "*feed the models with their real market values, the performance of the models is not robust enough in order to justify global acceptance".*

Dempsey (2013) concludes that *"unfortunately, the facts do not support the CAPM*." He also notes that "*A good deal of finance is now an* ***econometric exercise in mining data****… The accumulation of explanatory variables advanced to explain the cross-section of asset returns has been accelerating, albeit with little overall understanding of the correlation structure between them. We might consider that the published papers exist 'on the periphery of asset pricing'. They show very little attempt to formulate a robust risk-return relationship that differentiates across assets."* He finishes with a sensible recommendation: *"we must seek to understand markets on their own terms and not on our own".*

Stassopoulos (2013) affirms that "*Rear-View Mirror Is Misleading***"**, that **"***the past is no guide to future performance*" and that the "*rear-view mentality is not the only problem that bedevils traditional methods of assessing future risk*". Nevertheless he also advices learning from the past: "*think of plausible reasons why a stock has failed to reach our price target, grouping them under four general headings: compliance, financial, operational and strategic".*

Antoniou, Doukas, and Subrahmanyam (2014) argue that "*the security market line (SML) accords with the CAPM by taking on an upward slope in pessimistic sentiment periods, but is downward sloping during optimistic periods*". "*High beta*

[17] Fernandez and Bermejo (2009) (http://ssrn.com/abstract=1406923) compute the correlations of the annual stock returns (1989-2008) of the Dow Jones companies with a) β Rm; and with b) Rm; and find that the 2nd correlation (assuming β = 1 for all companies) is higher than the first one for all companies except Caterpillar and GM. Rm is the return of the S&P 500. Carvalho and Barajas (2013) study the betas in the Portuguese market and conclude that *"the results could reinforce the position of those who affirm that calculated betas do not work better than beta = 1".*

stocks become overpriced in optimistic periods", "*CFOs can use the CAPM for capital budgeting decisions in pessimistic periods, but not optimistic ones". "Betas are calculated using 24 to 60 monthly returns (as available)"*

Gilbert *et al.* (2014) report that *"beta, varies across return frequencies".* They show that *"Berkshire has a market beta below 0.60 when estimated with daily return data but a beta of about 0.95 when estimated with quarterly data".* They conclude that *"beta differences across frequencies occur even in large and liquid stocks and cannot be explained by microstructure and trading frictions."* They calculate the betas using returns over the previous 60 months.

According to Greenwood and Shleifer (2014), *"the evidence is not consistent with rational expectations [of] representative investor models of returns".*

A model that works perfectly at the individual level may not function at the aggregate level (the market)[18]. For the CAPM, this means that although the CAPM could be an appropriate scheme for an investor, it is not valid for the market as a whole because investors do not have the same expectations of return and risk for all stocks. The value of each stock according to each investor is the present value of the expected flows discounted with a rate (which depends on the expected beta and the expected market risk premium). Different investors have different expectations of flows and different expectations of risk (expected beta and expected market risk premium).

Exhibit 3. Comments from readers

I will explore the possibility to discuss these issues in my class.

I really appreciate your efforts in Finance Research.

Another great write up, really excellent and succinct explanations.

In a Corporate treasury peer group meeting I attended last month, WACC or hurdle rate is one of the hot topics raised by Corporate treasures for capital structure planning and capital allocation strategies evaluation. It is hard to get a universal WACC or hurdle rate applied to everything. That is the conclusion from the discussion.

Me ha gustado mucho. Me siento tambien muy ''vindicated'' con el comentario sobre Sharpe Ratios. Muy claro.

I read your paper and can say the following:
1. The "18 finance topics" are probably interesting topics - each of them - but how were these 18 aspects identified and listed? What was the methodology to do that?
2. The scientific relevance of all 18 topics is probably out of question. But what about the real (empirical) relevance? I have already changed my internal audit environment several times, including one time at a DAX 30 company, but I was never confronted with one of these issues (WACC, CAPM etc.). Therefore, to understand the relevance of all 18 topics better, it could be helpful for your readers to connect the theoretical explanation with practical consequences. Were there any detrimental effects to companies when misusing or miscalculating WACC/CAPM-values etc.?
3. The quality of academic teaching: Why do finance professors explain these 18 issues badly? Are there any statements, why? And why do 71% of professors use betas, whereas 29% don't? What are the reasons and consequences?

Wonderful paper. I appreciate the efforts made by you to research on the topics that are 'really' badly explained by some of us. These are common blunders made by many of us when we teach financial management to MBA students. These blunders are carried by them when they go the industry and make wrong decisions. They actually destroy shareholders' wealth instead of creating it.

Great to see you focus on the value of real-world learning and not the text book world, keep it up! I just wanted to share with you the warning I provide to my Finance students:
1. The textbook world is not like the real world
2. In the textbook world there is TRUTH, in the real world there is only OPINION.
3. In the textbook world there is RISK, in the real world there is UNCERTAINTY.

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[18] Mas-Colell *et al.* (1995, pg. 120): *"It is not true that whenever aggregate demand can be generated by a representative consumer, this representative consumer's preferences have normative contents. It may even be the case that a positive representative consumer exists but that there is no social welfare function that leads to a normative representative consumer".*

4. In the textbook world everything is OBJECTIVE (there is only one answer), in the real world everything is SUBJECTIVE (there are many possible answers).
5. In the textbook world everything is STABLE, nothing ever changes. It is a repeated game. In the real world everything is FRAGILE, it changes all the time. Today will never appear again.
6. In the textbook world all you need is TRAINING (LOTS). In the real world you need THINKING (HOTS). There are no recipe solutions, you need to be adaptive and openminded.
7. In the textbook world you CANNOT ADD VALUE. In the real world you MUST ADD VALUE to survive.
8. In the textbook world, you are only dealing with books, lecture notes, and lecture recordings (since most of you don't turn up to class). In the real world you are dealing with bosses, subordinates, colleagues, clients, shareholders, regulators, the tax office, unions, etc.
9. In the textbook world you need to STICK TO YOUR ASSUMPTIONS, in the real world you need to LET YOUR ASSUMPTIONS GO.
10. In the textbook world, only your grades are at stake. In the real world your livelihood, family, reputation, bonus, superannuation, your company's survival, your company's image and your client's money are at stake.
11. In the textbook world you are dealing with BOUNDLESS RATIONALITY. In the real world, EMOTIONS mess with you.
12. In the textbook world TIME DOES NOT EXIST. In the real world TIME IS YOUR WORST ENEMY.
13. In the textbook world with hard work NOTHING IS IMPOSSIBLE, in the real world even with hard work FAILURE often looms.
14. In the textbook world, you only deal with ON AVERAGE RESULTS, in the real world AVERAGE PEOPLE for whom the outcome is directed DO NOT EXIST.

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