

# ITERATIONS IN COMPANY VALUATION – EMCINSMED PLC.

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## Abstract

*DCF is the most respected method of company valuation. However, it does have a flaw related to the fact that the weights (share of debt and equity in total financing) that are used are based on book values. The problem may be overcome by using a technique based on iterations. In a real-life case, when one has to deal with numerous parameters and time periods, a numerical solution seems to be the only feasible approach. It is a chain of formulae that becomes so integrated that the information between cash flows and cost of capital moves freely. Loops run along columns (from  $V$  to  $WACC$ , and from  $E$  to  $k$ ) and lines (from one year to another). The cost of capital “tracks” the capital structure and changes accordingly. The valuation is recursive, going backwards in time. In general, the recursive method of company evaluation overcomes a fundamental problem that is often ignored by many other methods: the fact that the cost of capital depends on the financial structure. Here in the paper, the valuation of Emcinsmed S.A. company is done in order to present the i-DCF valuation method. The company is highly leveraged, hence it serves as a good example.*

**JEL classification:** G32, C53, G12

**Keywords:** company valuation, DCF, iterations

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## Introduction

Valuation methods used in a business environment can be boiled down to three main groups: income, asset and market-based approaches. The income-based method (DCF) is the most coherent concept – the value of a company depends on cash flows the company will generate in the future. The cash flows depends on factors often ignored by the other methods: technology, organizational structure, human resources, intangible assets, etc – hence the fact that DCF methods are superior comparing to others is rarely questioned. DCF approach is also relatively simple as it is composed of three steps: generating forecasts, estimating a cost of capital and defining the discounting process itself.

Classical DCF valuation, however, is flawed since it uses capital structure based on book values for the company value calculations. It leads to a contradiction – one is looking for the real value of the company but in the meantime he uses its book values as inputs. No wonder the final result may be significantly warped, especially in the case of the companies where book values of equity are very different from the genuine ones.

The flaw can be easily remedied with the use of iteration techniques. Depending on whether debt or capital structure is given, loops will run along columns (from  $V$  to  $WACC$ , and from  $E$  to  $k$ ) and lines (from one year to another). It creates additional technical problems in a form of

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a logical loop but this can also be remedied. The valuation is recursive, going backwards in time.

In general, the recursive method of company valuation overcomes a fundamental problem that is often ignored by many other methods: the fact that the cost of capital depends on the financial structure. This is especially evident in a case of companies that are highly leveraged and having a volatile capital structure. We made an attempt to value one of such companies – Emcinsmed plc.

## **Business Valuation Methods**

There are three basic approaches to business valuation:

- 1) Asset-Based Approach,
- 2) Income Approach,
- 3) Market Approach.

The methods are clearly defined in the vast literature of the subject. The income approach determines the value of a company, financial or intangible asset by using a method that converts expected benefits into its present value (with the use of a discount rate and time value of money procedures). There is also the “peer comparison” (Benninga & Sarig 1997, p. 330) method (or market, or multiple approach) (Vernimmen, 2005), where a company is valued by analogy with other assets or companies of the same type. This pragmatic approach assumes that markets are efficient, and the value of one company should be measured by reference to another’s value. In another approach (asset approach, or restated net asset value) a company is valued as the sum of its assets less its net debt. There are numerous variations of the method, starting with a crude one based on book values. There are attempts to apply options theory – this seems a tempting theoretical concept, which may potentially represent a profound shift in the way equity capital is valued. Real options are a good example of such an approach.

The set of valuation methods that is actually in use in a given country is usually shaped by its history and economic environment. In Poland for example, after the fall of communism in 1989, a lot of previously state-owned property started to be commercialized and then privatized. One of the provisions of the Ministry of Treasury issued at that time specified that at least two out of the five valuation methods that were listed there must be used whenever any of the state-owned companies were to be privatized and sold. Since then, the five methods have become a benchmark for company valuations even if they were done for purposes other than commercialization and privatization (Capiński & Patena, 2008). The list includes:

- 1) replacement method,
- 2) restated net asset value method,
- 3) liquidation value method,
- 4) multiple method,
- 5) DCF method.

The choice (with regard to methods) made by companies performing company valuations depends on a number of factors. In most cases, as suggested by the applicable provision, at least two methods are utilized so that the brackets with the lowest and highest values are formed and facilitate negotiations with potential investors. If the financial market is stable and a company generates positive cash flows, DCF and comparative methods are used in most

cases. Some of the differences in the values generated by the methods stem from the lifecycle theory of company value (Maślankowski & Patena, 2009). For example, quite naturally if the company enters a post-maturity phase, its profits decline and the cash flow value slips below the restated net asset value. Companies that barely break even, but have a lot of marketable assets are valued with the use of restated net value method. The restated net value being higher than the DCF value may be an indicator that the company should gradually divest and liquidate its assets to boost profitability. Those already in the red are bound to use the liquidation value method.

In many countries there are valuation standards dealing with the methodology and the scope of knowledge the evaluator must have. Most of them have been developed by professional associations such as:

- 1) NACVA (National Association of Certified Valuation Analysts),
- 2) ASA (American Society of Appraisers),
- 3) IBA (Institute of Business Appraisers).

### **DCF and iteration techniques**

The DCF method clearly dominates in most of the valuations of economically sound companies. In contrast to other methods, DCF requires sophisticated theories and mathematical models to support it. The concepts of perfect market, time value of money, cost of capital, portfolio theory and many others laid the foundation for DCF valuation. There are certain standards that apply when DCF is used, some are the part of the common knowledge and are clearly codified, and others have to be presented in detail. DCF however has some flaws – one of them is that one often refers to the capital structure that is based on book values – this significantly warps the final judgment. The obstacle may be overcome by using iterations in the valuation process.

The basic notion of the DCF method can be introduced with the following valuation formula:

$$V_0 = \frac{FCF_1}{(1+k)^1} + \frac{FCF_2}{(1+k)^2} + \dots, \quad (1)$$

where:

- subscripts 1, 2, ... represent the first and further periods,
- k represents a cost of capital,
- FCF – free cash flow.

This is how the company's value is determined: certain cash flows are discounted with the cost of capital. There are three components involved: cash flows, cost of capital and the model (or engine, technically speaking) explaining how the first two are related and eventually put together into a coherent system (Kruschwitz, 2006). The problem we are facing is to:

- 1) estimate future cash flows,
- 2) determine a discount factor – cost of capital.

Future expected cash flows will be calculated on the basis of strategic plans and financial documents *pro forma* of a company. The starting point for such calculations is sales predictions which are preceded by a macroeconomic analysis. The prospects of economic

growth of the economy affect the predicted increase of purchasing power and demand. What follows, is the microeconomic analysis that may help calculate a unit price and the level of sales. In practice, the sales from the previous period of time is accepted as a starting point, then an increase of several basis or percentage points is assumed. Costs can be predicted from analyzing company operations, but simultaneously they have to be viewed from a larger perspective, taking into account a number of other factors. Such predictions are usually made for a period of 5 to 9 years. Further prognosis poses an obvious challenge (Capiński & Patena, 2008). Then, a simplifying assumption is made (in form of a growing perpetuity) and this number is called the residual value.

The planned future cash flows are only expected values. In practice, a certain amount risk is involved and there will always be some discrepancies between planned and realized values. This fact is taken into account in choosing a discount rate (cost of capital) that reflects the level of uncertainty that is risk.

Once we have financial documents *pro forma*, we can calculate the cash flows. There are two basic valuation methods, corresponding to two kinds of cash flows: CF and FCF.

1. FCF – Free Cash Flow (cash flow available for both shareholders and debt holders). FCF is cash that is generated by a company's operational activity without taking interest or debt payments into account. We hypothetically assume a situation where a company is equity financed only. The formula below is used in this case:

$$FCF = EBIT \times (1 - T) + \text{correction}$$

The correction involves adding back depreciation and the value of actual investments made by a company in working capital and fixed assets. The tax shield is not ignored but included in the calculations of cost of capital (WACC- weighted average cost of capital). Then FCF is discounted and the value of a company is obtained. The method is called Flow to Firm (FTF), or indirect method, since the value of equity is found indirectly.

2. CF – Cash Flow (cash flow available for shareholders only). We calculate cash flows CF available for shareholders:

$$CF = (EBIT - k_D \times D) \times (1 - T) + \text{correction} + \Delta D.$$

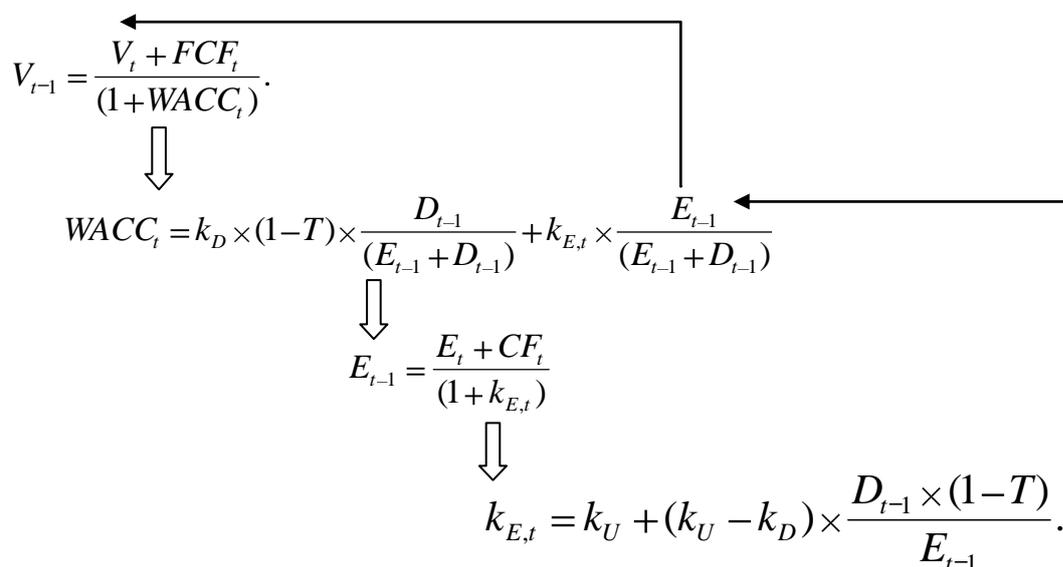
CF is discounted with the cost of capital, which is the rate of return required by shareholders. The method is called Flow to Equity (FTE) or the direct method.

There are certain technical problems that are likely to appear in the calculations described so far.

- 1) One has to know the cost of capital WACC (and both its components: cost of debt and cost of equity) in order to calculate the value of a company.
- 2) One has to know the capital structure, that is the value of debt and equity, in order to calculate the cost of capital (cost of equity or WACC).
- 3) One has to know the value of interest payments, which is the value of debt, in order to calculate cash flows.

The problems create a logical loop: step 1 needs step 2, but step 2 requires step 1. The problem seems technical, but as a matter of fact it is a profound shift in the way the value can be found. In case of a schoolish example where a company is often represented by a perpetuity finding the company's value by solving a system of equations is quite viable. In a real life case, however, when one has to deal with numerous parameters and time periods, a numerical solution seems to be the only feasible approach. For example, in order to find the value  $V$  (for a given year  $t$ ), one needs to know the values of  $WACC$ , next  $E$ , and then  $k_E$ . It is impossible to calculate  $WACC$  without  $V$  (the one we look for), and  $E$  without  $k_E$ . There appears to be many logical loops in the formulae shown below. The only way to tackle the problem is to rely on iteration process. Then, the formulae in the chain become so integrated that the information between cash flows and cost of capital moves freely. The cost of capital "tracks" the capital structure and changes accordingly, while  $CF$  is a reflection of future profits and also the level of debt in the company (Capiński & Patena, 2008). This is the value-added of the iteration-based method.

(2)



where:

$k_D$  – cost of debt,

$k_E$  – cost of equity,

$k_U$  – cost of capital of an unlevered company,

$CF$  – equity free cash flow,

$FCF$  – firm free cash flow,

$E, D, V$  – market values of equity, debt and the whole firm correspondingly.

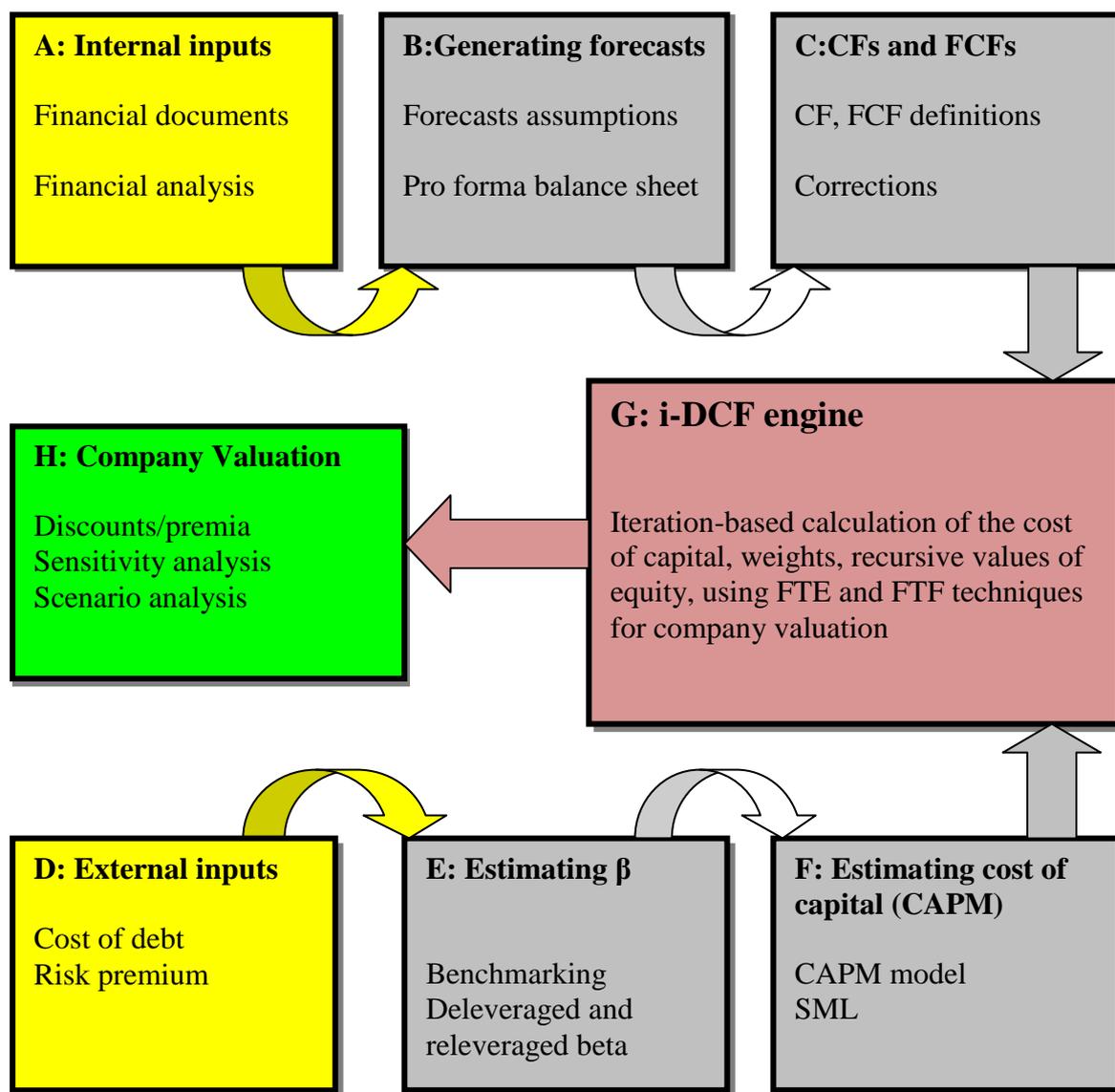
Similar loops will appear if one uses the *FTE* method (*CF-based*) instead of *FTF* (*FCF-based*). Depending on whether debt or capital structure is given, loops will additionally run along columns (from  $V$  to  $WACC$ , and from  $E$  to  $k$ ) and lines (from one year to another). The valuation is recursive, going backwards in time. To conclude, calculating the value of a

company without using iterations is tantamount to applying the wrong weights to WACC and leads to an inner contradiction.

In general, the recursive method of company valuation overcomes a fundamental problem that is often ignored by many other methods: the fact that the cost of capital depends on the financial structure (Capiński, 2005). It creates additional technical problems in a form of a logical loop but this was also remedied.

## Company Valuation

Figure 1: DCF procedures



Source: Author's elaboration

The subject of valuation is „EMC Instytut Medyczny S.A.” – a medical company that owns and operates 5 hospitals and 11 medical centers in the region of southern Poland. Over 80% of the revenues of the company comes from National Health System (NHS) contracts. The development strategy of the company assumes providing medical care to 2 million people. Besides, since 2007 the company has gone abroad and conducts medical centers in Ireland as well.

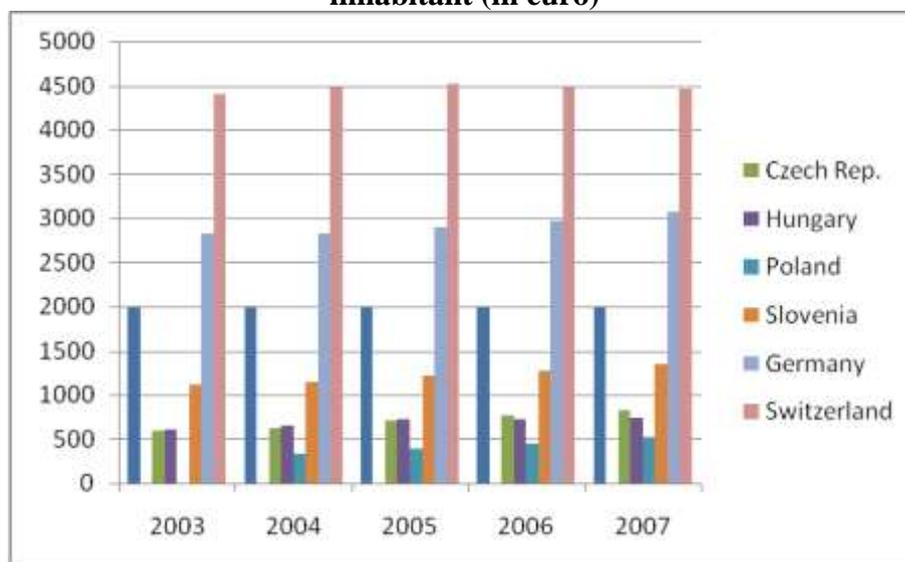
All the forecasts (including *pro forma* documents: balance sheets, income statements, cash flow statements, ration analyses) have been generated by an interactive financial planning system IFPS (Shim, 2006). The core of the model are equations referring to input data and, based on specifically defined assumptions, generating particular components of *pro forma* financial documents.

The IFPS model creates a coherent system of financial planning. In the particular case debt is a plug – it changes automatically whenever assets exceed liabilities. In the assets, cash is a plug – it is kept on the level that is justifies operationally but grows if liabilities exceed assets. The forecasts are based primarily on historical data published at <http://www.emc-sa.pl>, macroeconomic and industry analysis.

All the values are given as nominal (taking inflation into account). The forecasts are drawn up to 2018 – the long period is justified by the industry characteristics and the dynamics of the changes in the industry. Specific assumptions for revenues, costs, capex, financing etc. are presented below. They result in forecast of balance sheets, income statements, cash flow statements for the years of 2010-18.

### Assumptions for revenues and costs

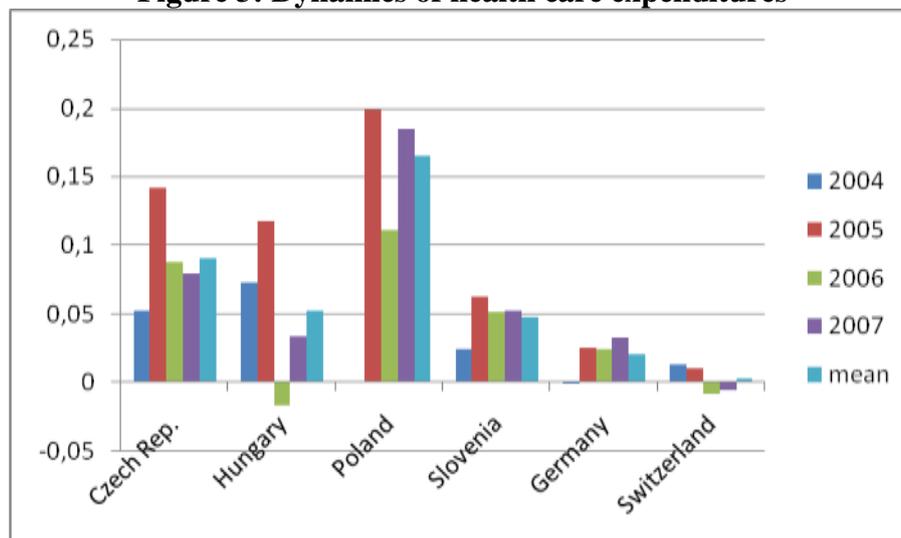
**Figure 2: Expenditures of selected health care functions by providers of health care, per inhabitant (in euro)**



Source: Based on [www.eurostat.com](http://www.eurostat.com)

Historical data clearly show that over 80% of the revenues of the company comes from NHS contracts. Apparently, the company is to a large extent dependent on the state's expenditures related to the public health system (figure 2.). The revenues forecasts then must be closely related to the expenditures. Figures 2 and 3 present historical expenditures on public health system in a few selected European countries.

**Figure 3: Dynamics of health care expenditures**



Source: Based on [www.eurostat.com](http://www.eurostat.com)

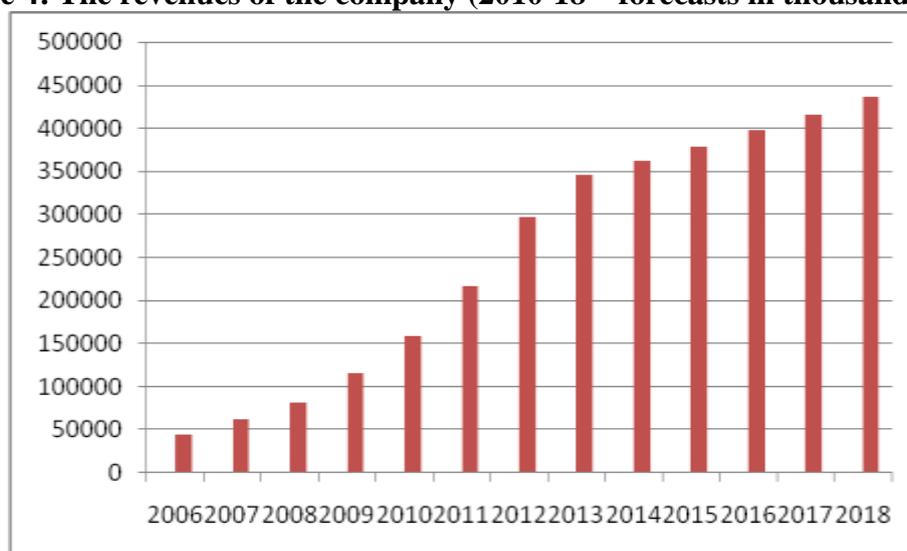
It has been found out that in Poland in the years 2003-2007 the health care expenditures were growing at the pace of 16,53% each year. Assuming similar dynamics in the years to come, Poland in 2012-13 will achieve the level of expenditures Slovenia incurred in 2003. It has been assumed that after this period, the NHS expenditures in Poland will grow at the average rate 4.77%, Slovenia had in the years 2003-7.

The company's revenues grow more dynamically than the public health care system expenditures in Poland – on average at the rate of 36,87% in 2006-2009. It has been assumed that the company will sustain similar dynamics of revenues growth in 2010-12, and then in 2013 its revenues will grow at the same pace as NHS expenditures (16.53%), finally in the years of 2014-18 they will grow with the dynamics comparable to another benchmark, that is Slovenia (4.77%).

The costs of operational activity have been forecasted *via* the internal cost components: costs of goods sold, materials, energy, outsourced services, wages, depreciation, tax payments and others. The forecast is based on the profit margin, the existing cost structure and assumptions concerning possible changes in the cost structure in the coming years. The cost structure in the years of 2010-18 is identical as the one in 2009. Moreover, it is assumed that profit margin in 2010 is the same as the average profit margin in the years of 2006-9. The costs/revenues ratio was 0,9449 then.

Depreciation costs result from the existing fixed assets value. The forecasted capex are consistent with the revenue dynamics. The depreciation rate are set in a fixed relation (9.4% in 2009) to the value of fixed assets.

**Figure 4: The revenues of the company (2010-18 – forecasts in thousands PLN)**



Source: Author's elaboration

Besides, it is assumed that the key balance sheet components change consistently with the changes in revenues. In addition to this, the values of AR, AP and inventory were set based on the ratios: DSO, accounts payables and inventory turnover (respectively, 33-34 days for AR, 3-4 for inventory, 48-9 for AP) calculated from the most recent data before the valuation date. The cash is kept on the level that is operationally justified (10% of AP) but increased automatically (as described earlier in the IFPS model) whenever temporarily liabilities exceed assets. Reserve capital is left at the previous level (the end of 2009). 100% reinvestment ratio is assumed as the company has never paid any dividend, nor has it indicated it may wish to pay it in the near future. The revenues and costs forecasts are generated automatically in the IFPS system. The system is iteration based – the debt and cash adjust according to the changes in the other entries of the balance sheet and the income statement. Extraordinary incomes and losses are assumed zero throughout the whole forecast period.

The *pro forma* financial documents are the starting point for estimating cash flows (both CF and FCF) according to the previously explained formulae. Then the residual value is estimated using a growing perpetuity model. The long term growth factor is estimated at 3.8% with the use of the standard model for calculating  $g$  for leveraged firms (Cigola et al., 2003).

$$g(l) = \frac{(r - lh) \times (1 - T) \times m}{(1 - l)} \quad (3)$$

where  $g(l)$  = growth factor for leveraged firms,  
 $R$  = ROE,  
 $L$  = debt ratio (D/V),  
 $T$  = tax ratio,

- m = reinvestment ratio (50% ratio is assumed starting from 2019),  
h = cost of debt.

The accepted value of the growth ratio is consistent with the average growth rate of public health care system in developed European countries (Germany and Switzerland) in the years of 2003-7 (PPP based values).

The value of the company is found recursively by discounting with a cost of capital that changes according to the capital structure at each of the stages (years) until one gets the present value. After deducting debt and adding nonoperational and off-balance assets one receives the value of equity.

### Cost of equity

Cost of equity is estimated according to the CAPM model, where the required rate of return is given with the following formula.

$$k_e = r_{rf} + \beta(k_M - r_{rf}) \quad (4)$$

where  $r_{rf}$  = risk free rate of return,  
( $k_M - r_{rf}$ ) = risk premium.

The global market risk premium is accepted after *Global Investment Returns Yearbook* by E. Dimson E., Marsh P., & Staunton M. (2009) (expected long term 3.5%) increased by country risk premium (2.4% according to Damodaran 2009 Country Risk Premiums, <http://pages.stern.nyu.edu/~adamodar>), altogether 5.9%. Industry beta for Medical Services is used (0.72) (average of 172 companies) according to Damodaran's Betas (dated January 2010). Beta is then releveraged. Its value after the process becomes 0.85. The risk free rate (6.17%) is identical to YTM of T-bonds with 20-maturity (<http://www.rynek.bizzone.pl>). To sum up, the cost of equity estimated according to CAPM model and SML formula (Security Market Line) is:

$$k_e = r_{rf} + \beta(k_M - r_{rf}) = 6.17\% + 0.85 \times 5.9\% = 11.18\%$$

In the next years the cost of capital is slightly corrected as certain changes in the country risk premium (currently 2.4%) are anticipated. We assume that as soon as Poland enters the euro zone the premium falls to 1.5% (Slovenia is the benchmark here), and in 2017 it falls to zero (Spain being the relevant benchmark now). Then, the deleveraged cost of capital will become 10.70% in the years of 2009-2014, 9.93% in the years of 2015-16, and 8.66% starting in 2017. The value of cost of capital is additionally dependent on the capital structure and may have different values than the deleveraged one.

The cost of debt is assumed at 7.95% in 2010 (WIBOR 1Y 4.45% plus bank's margin of 3.5% - data dated 30.05.2010). Next, it is determined *via* the term structure of interest rate. The interest rate for deposits is assumed at 3.31% (WIBID O/N dated 30.05.2010).

The value of the company estimated with i-DCF

**Figure 5: CF and FCF calculations**

	2010	2011	2012	2013	2014	2015	2016	2017	2018
1 EAT	4 122	5 769	9 204	11 041	11 648	12 437	13 620	14 626	15 888
2 Depreciation	5 456	6 357	7 408	8 631	10 057	10 537	11 040	11 566	12 118
3 AR	-3 940	-5 392	-7 381	-4 526	-1 523	-1 595	-1 671	-1 751	-1 835
4 Inventory	-320	-485	-663	-407	-137	-143	-150	-157	-165
5 Prepaid expenses	0	-113	-69	-23	-24	-26	-27	-28	-29
6 AP	5 288	7 238	9 907	6 075	2 044	2 141	2 243	2 350	2 462
7 Accrued liabilities	0	341	467	286	96	101	106	111	116
8 Fixed assets	-12 581	-15 941	-18 575	-21 643	-25 219	-15 638	-16 384	-17 165	-17 984
9 Required cash level	0	0	0	0	0	0	0	0	0
10 Correction (3+4+5+6+7+8+9)	-11 552	-14 352	-16 315	-20 238	-24 763	-15 160	-15 883	-16 641	-17 435
11 Short term debt	-3 804	0	0	0	0	0	0	0	0
12 Long term debt	8 897	12 178	0	0	0	-4 500	0	0	0
13 CF (1+2+10+11+12)	2 961	9 698	-247	-1 118	-3 593	2 867	8 234	8 754	9 496
14 T	19%	19%	19%	19%	19%	19%	19%	19%	19%
15 EBIT	8035	10 998	15244	17890	18744	19638	20574	21556	22584
16 FCF (15*(1-14)+3+10)	412	914	3 441	2 884	477	11 283	11 822	12 386	12 976

Source: Author's elaboration

**Figure 6: i-DCF engine**

FCF	412	914	3 441	2 884	477	11 283	11 822	12 386	12 976
D	27931	33024	45202	45202	45202	45202	45202	45202	45202
E	126632	137093	141527	157142	174984	197142	210864	223625	237089
KE	11,19%	11,13%	11,27%	11,04%	11,00%	10,97%	10,16%	10,15%	8,82%
kD	7,95%	8,47%	8,47%	9,24%	9,24%	9,24%	8,60%	8,60%	7,60%
ku	10,70%	10,70%	10,70%	10,70%	10,70%	10,70%	9,93%	9,93%	8,66%
WACC	10,33%	10,30%	10,21%	10,24%	10,28%	10,32%	9,60%	9,62%	8,40%
V(FTF)	154563	170117	186730	202345	220187	242344	256066	268827	282291
T	19,0%								
g	3,8%								

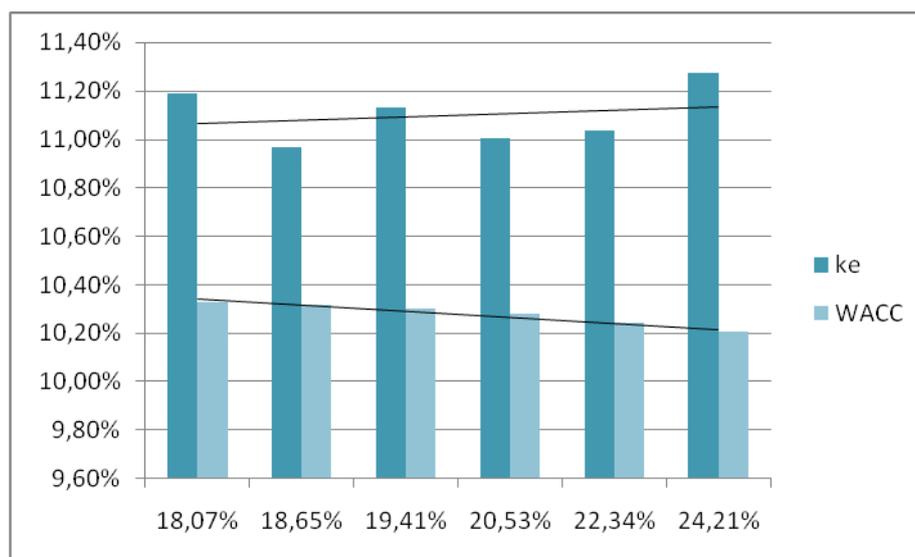
Source: Author's elaboration

As a result of using i-DCF approach, the value of the company at the end of 2009 is estimated at the level of 126 632 000 PLN. The complete set of calculations is presented at figure 6. Then, nonoperational assets are added. In the balance sheet at the end of 2009 cash is kept at the level that is higher than operational. The difference is treated as a nonoperational asset of 4 794 700 PLN. Finally, the value of the company estimated with DCF method is 131427 000 PLN. There are 6637612 shares in circulation. Hence, the value of a single share is 19.08

PLN. For comparison, the market price of a share quoted at Warsaw Stock Exchange at the beginning of 2010 is 24.50 PLN – the stock seems to be significantly overestimated.

It must be noted that according to the assumption of the i-DCF approach the cost of capital tracks the capital structure of the company and it is changed accordingly (figure 7.) basically getting lower whenever the debt ratio is increased. For example, WACC is 10.33% and 10.21% with D/V equal to 18.07% and 24.21%.

**Figure 7: WACC versus company's capital structure (D/V)**



Source: Author's elaboration

## Conclusions

Classical DCF valuation is flawed since it uses capital structure based on book values for the company value calculations. It leads to a contradiction – we are looking for the real value of the company but in the meantime use its book values as inputs. No wonder the final result may be significantly warped, especially in the case of the companies where book values of equity are very different from genuine ones. The flaw can be easily remedied with the use of iteration techniques. The recursive iteration-based method of company valuation overcomes a fundamental problem that is often ignored by many other methods: the fact that the cost of capital depends on the financial structure. It creates additional technical problems in a form of a logical loop but this was also remedied.

The attempt to value Emcinsmed plc. with the use of iteration-based DCF seems to be successful. The company was chosen as it is highly leveraged. Thanks to the fact, one can watch the ubiquitous effect of using iteration techniques – loops running along columns (from  $V$  to  $WACC$ , and from  $E$  to  $k$ ) and lines (from one year to another). The valuation is recursive, going backwards in time. The cost capital tracks the changes in capital structure and changes accordingly. Thanks to the technique the value of a company can be decently estimated. In the case of Emcinsmed plc. the estimated value appears to be much lower than the market one.

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