VALUE OF TAX SHIELDS FROM DEBT FINANCING OF INVESTMENT PROJECTS

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Debt financing of investment projects, used to complete internal sources, has benefits that increase company value (tax shields from interest payments deduction), but also implies costs of financial distress (bankruptcy costs and agency costs) that decrease market value of debt and company value. In this paper, we discuss how taxes affect financial structure choice and we estimate tax shields from debt financing for an investment in real assets, using four different models developed in financial literature.

Key words: real assets investments, debt financing, tax shields, marginal tax rate

Role of corporate and individual income taxes in choosing financial structure

Although all companies operating in a national territory face the same statutory corporate tax rate, *marginal tax rate* depends on tax shields that a certain company could obtain. We can define *effective tax rate* as the statutory rate multiplied with probability of having positive taxable income that allows tax benefits.

Mackie–Mason [1990] establishes a substantial effect of taxation on financial structure choise, which becomes more important as company approaches the point where tax benefits source exhausts. This means that deduction of every unit of interest must be appraised using a marginal tax rate as decreasing function of interest expenses.

Graham [1996] achieves important results in this research field. He builds a complex simulation methodology to estimate marginal effective tax rate (set as weighted average using probabilities of not paying income taxes), used later in his study in year 2000. The average net value from deduction of interest expenses is about 4.3% of market value of companies in the sample. They estimate net advantage from deduction of the last unit of interest payment to 13–25% for extremely profitable companies and 8–15% for profitable companies. Present value of tax shields from debt financing is about 9.7% of firm market value. Kemsley and Nissim [2002] reach to a similar result (10%). In this particular sample, tax shields represent about 40% of market value of debt. Graham [2001] returns to this item simulating marginal tax rates for thousands of US companies and supplies empirical evidence that tax benefits from debt financing are between 5 and 10% of market value for a company, reconfirming his previous results.

Empirical studies demonstrate that debt financing becomes more attractive to investors as effective marginal tax rate enhances. As tax shields from other sources than debt (for instance, depreciation) increase, marginal tax rate decreases and debt financing is discouraged. The two different sources of tax shields (operational and financial) are interchangeable.

Assessment models for tax shields from debt financing

Many authors propose alternative models to estimate the present value of tax shields from debt financing. Most frequently used formulas are presented in Table 1 (VA[a,b] is the present value of cash flow "a" discounted with rate "b"). We notice that discount rate for cash flows obtained because of interest expenses deduction is not the same for all models and it depends on kinds of risk attached to these cash flows.

Modigliani–Miller [1963] (from now on MM) consider that tax shields are not risky, so we can use risk free rate (r_f) as discount rate and the present value for these cash flows is $D \times \tau$. However, the taxation level of the income for individuals also influences tax advantage. That is why Benninga and Sarig [1998, pp. 259] consider corporate and individual taxation (Miller [1977]):

$$\text{PV (tax shields)} = \sum_{i=1}^{\infty} \frac{\left[(1-\tau_d)-(1-\tau_e)\times(1-\tau)\right]\times Dob_i}{\left[1+(1-\tau_d)\times r_d\right]^i}$$

Myers [1974] notes that tax shields have the same risk with debt, so the discount rate is the interest rate r_d. In fact, only tax benefit for the first year is certain and we may discount it with rate of interest. For subsequent years, the debt value depends on the project market value V^L and the level of fixed leverage L ($L \times V_L$). Because of uncertainty of realizing tax shields from debt financing, its risk changes over time and the discount rate is cost of equity capital for unlevered company (r^U), which includes only the operational risk[201]. The amount of all these tax shields obtained in perpetuity is:

$$\text{PV (tax shields)} = \frac{D_0 \times r_d \times \tau}{r^U} \times \frac{\left(1+r^U\right)}{\left(1+r_d\right)}$$

Other cited authors are using cost of capital for unlevered company (r^U).

Authors	Assessment models
MM [1963]	PV [$D\tau r_f$; r_f]
Myers [1974]	PV [$D\tau r_d$; r_d]
Miles and Ezzell [1980]	PV [$D\tau r_d$; r^U]$\times(1+r^U)/(1+ r_d)$
Harris and Pringle [1985], Ruback [2002]	PV [$D\tau r_d$; r^U]
Damodaran [1994]	PV [$D\tau r^U - D\times(r_d - r_f) \times(1-\tau)$; r^U]
Fernandez [2004]	PV [$D\tau r^U$; r^U]

Table 1. Assessment models for tax shields from debt financing

There are isolated opinions that consider that the supplementary value coming from tax shields is not equal with the present value of tax shields. For instance, Fernandez [1994] emphasizes that estimating discount rate for these cash flows is a challenging task because the value of tax shields from debt financing (VTS) is given by taxes paid by unlevered company (G_U) minus taxes paid by levered company (G_L), while each of them has a different level of risk: $VTS = G_U - G_L$.

Cooper and Nyborg [2006] contradict this point of view. They demonstrate that the value of tax shields is equal with the present value of tax shields. The surprising result of Fernandez [1994] is due to wrong usage of an argument, valid only for MM [1963] model.

Case study

In this section, we focus on appraisal of tax shields from debt financing for a project in construction materials field. A rigorous and detailed analysis of the project, assessment of free cash flows and discount rate was performed before and it is not the purpose of this study. That is why we concisely present some elements, to create the basis for further analysis. We estimated free cash flows in USD because some cost elements are also specified in USD.

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[201] PV (tax shields, year 1) = $\frac{D_0 \times r_d \times \tau}{\left(1+r_d\right)}$, PV (tax shields, year 2) = $\frac{D_0 \times r_d \times \tau}{\left(1+r^U\right)^2} \times \frac{\left(1+r^U\right)}{\left(1+r_d\right)}$,

PV (tax shields, year 3) = $\frac{D_0 \times r_d \times \tau}{\left(1+r^U\right)^3} \times \frac{\left(1+r^U\right)}{\left(1+r_d\right)}$ and so on.

Operating period for analyzed investment is ten years (2008–2017). The cost required to implement the project is 6,670 thousands USD, consisting of land (280 thousands USD), buildings (270 thousands USD) and technology (6,120 thousands USD). Working capital investment of 244.6 thousands USD for year 2008 depends on estimated turnover. Finally, nominal free cash flows are discounted with nominal cost of equity capital of 18.3%, resulting NPV of 2,733 thousands USD for analyzed project.

Internal financing source is 2,018.6 thousands USD (net income from previous years) and it is used to entirely finance land, buildings, working capital and 20% of technology value, while 80% of equipment purchase value (4,896 thousands USD) comes from debt financing. Valuation of the tax shields is similar, no matter what kind of debt we use. That is why we analyze a source of debt financing used for 10 years (life of the project). Debt refunding is done by 120 fixed monthly mensualities, starting in January 2008. Annual nominal rate of interest is 10.5%. The commission of 2% is retained from the loan, so that debt raised is 4,985.7 thousands USD (the commission represents 99.7 thousands USD of this amount).

Monthly rate of interest is 0.875% and value of a monthly mensuality is 67.27 thousands USD. Table 2 illustrates annual interest payments. The financial leverage, determined in concordance with the Fiscal Code, as annual average value of long term debt divided to annual average value of equity capital, does not exceed 3, which means that interest payments are entirely deducted in the same year.

Thousands USD

YEAR	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Long term debt (end of the year)	4,985.7	4,687.9	4,357.2	3,990.0	3,582.5	3,129.9	2,627.6	2,069.8	1,450.6	763.2	0.0
Average value of long term debt	0	4,836.8	4,522.5	4,173.6	3,786.2	3,356.2	2,878.8	2,348.7	1,760.2	1,106.9	381.6
Equity capital (end of the year)	1,774.0	1,774.0	1,774.0	1,774.0	1,774.0	1,774.0	1,774.0	1,774.0	1,774.0	1,774.0	1,774.0
Average value of equity capital	0	1,774.0	1,774.0	1,774.0	1,774.0	1,774.0	1,774.0	1,774.0	1,774.0	1,774.0	1,774.0
Leverage		2.7	2.5	2.4	2.1	1.9	1.6	1.3	1.0	0.6	0.2
Interest payments		509.4	476.6	440.2	399.7	354.8	304.9	249.6	188.1	119.9	44.1
Deducted interest payments		509.4	476.6	440.2	399.7	354.8	304.9	249.6	188.1	119.9	44.1

Table 2. Leverage and deducted expenses associated with debt financing

A company could not benefit from the tax shields from interest deduction if operating profit (EBIT) is negative or it is positive, but lower than the interest payments for debt. Because of the time value of money, such an advantage is less valuable if it is delayed.

Thousands USD

YEAR	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
EBIT	**480.1**	**763.6**	**1,348.1**	**2,046.0**	**2,869.1**	**3,512.6**	**3,417.5**	**3,324.1**	**3,232.6**	**3,142.8**
Interest payments	509.4	476.6	440.2	399.7	354.8	304.9	249.6	188.1	119.9	44.1
Other financial expenses (commissions)	99.7	0	0	0	0	0	0	0	0	0
EBT	**-129.1**	**286.9**	**907.9**	**1,646.3**	**2,514.3**	**3,207.7**	**3,167.9**	**3,136.0**	**3,112.7**	**3,098.7**
Cumulated loss	129.1	129.1	0	0	0	0	0	0	0	0
Recovered loss	0	129.1	0	0	0	0	0	0	0	0
Fiscal income	0	157.9	907.9	1,646.3	2,514.3	3,207.7	3,167.9	3,136.0	3,112.7	3,098.7
Income tax	0	25.3	145.3	263.4	402.3	513.2	506.9	501.8	498.0	495.8
Net Income	**-129.1**	**132.6**	**762.7**	**1,382.9**	**2,112.0**	**2,694.5**	**2,661.0**	**2,634.3**	**2,614.7**	**2,602.9**
Interest payments and commissions	609.2	476.6	440.2	399.7	354.8	304.9	249.6	188.1	119.9	44.1
Expenses that generate tax shields	**480.1**	**605.7**	**440.2**	**399.7**	**354.8**	**304.9**	**249.6**	**188.1**	**119.9**	**44.1**

Table 3. Net income and tax shields from debt financing

For our case study, EBIT for year 2008 is less than the expenses with interest payments and commission, so the tax shields is partly obtained in year 2009, when the net loss is recovered. Subsequently, tax shields are effectively realized in the same year when interests are paid, because operating profits have substantial positive value (Table 3).

In column (2) of Table 4, the interest and commission payments are “carried forward” in years when the tax shields are effectively generated. Corporate tax rate of 16% multiplied with interest expenses deduced

from EBIT represents the nominal tax shields (column (4) – this procedure is valid only for the first three methods).

Present value of tax shields – Myers [1974]

Monthly effective interest rate of 0.9158% (annual rate of 10.9896%) is determined as the internal rate of return that equals the amount of capital borrowed with present value of the 120 mensualities: $4{,}896 = \sum_{t=1}^{120} \frac{67.27}{(1+\mathrm{RIR})^t}$. Present value of tax shields is 343.6 thousands USD (column (6) of Table 4).

Present value of tax shields – Miles and Ezzell [1980]

Tax shields adjusted with $(1+r^U)/(1+ r_d)$ are discounted with the cost of equity capital (18.3%) and have a value of 295.7 thousands USD (column (8) of Table 4).

Present value of tax shields – Harris and Pringle [1985], Ruback [2002]

Benefits gained from tax shields associated with debt financing are liable only to operational risk, so the discount rate for unadjusted tax shields is still the cost of equity capital (18.3%) and have a value of 277.4 thousands USD (column (10) of Table 4).

Present value of tax shields – Benninga and Sarig [1998]

This method is preferable if external financing is gathered from individual investors that pay income taxes. For Romania, the three tax rates are equal to 16% and parameter used to adjust interest payments is $\left[(1-0.16)-(1-0.16)\times(1-0.16)\right]$ = 0.1344. In this situation, the tax shields have the same risk with debt and the adjusted discount rate is $(1-\tau_d)\times r_d$ = 9.23%. The present value of these cash flows is 363.7 thousands USD (column (13) of Table 4).

Thousands USD

Year	Deducted expenses with interest payments / commissions	Expenses that generate tax shields	Tax shields	Discount rate for tax shields (r) and present value of tax shields (PV(TS)) for assessment model proposed by:								
				Myers [1974]		Miles and Ezzell [1980]		Harris and Pringle [1985], Ruback [2002]		Benninga and Sarig [1998]		
				r	PV(TS)	r	PV(TS)	r	PV(TS)	Tax shields	r	PV(TS)
0	1	2	4	5	6	7	8	9	10	11	12	13
2008	609.2	480.1	76.8	10.99%	69.2	18.3%	69.2	18.3%	64.9	64.5	9.21%	70.3
2009	476.6	605.7	96.9	10.99%	78.7	18.3%	73.8	18.3%	69.2	81.4	9.21%	81.3
2010	440.2	440.2	70.4	10.99%	51.5	18.3%	45.4	18.3%	42.5	59.2	9.21%	54.1
2011	399.7	399.7	64.0	10.99%	42.1	18.3%	34.8	18.3%	32.7	53.7	9.21%	45.0
2012	354.8	354.8	56.8	10.99%	33.7	18.3%	26.1	18.3%	24.5	47.7	9.21%	36.5
2013	304.9	304.9	48.8	10.99%	26.1	18.3%	19.0	18.3%	17.8	41.0	9.21%	28.8
2014	249.6	249.6	39.9	10.99%	19.2	18.3%	13.1	18.3%	12.3	33.5	9.21%	21.6
2015	188.1	188.1	30.1	10.99%	13.1	18.3%	8.4	18.3%	7.8	25.3	9.21%	14.9
2016	119.9	119.9	19.2	10.99%	7.5	18.3%	4.5	18.3%	4.2	16.1	9.21%	8.7
2017	44.1	44.1	7.1	10.99%	2.5	18.3%	1.4	18.3%	1.3	5.9	9.21%	2.9
Total	**3,187.0**	**3,187.0**			**343.6**		**295.7**		**277.4**			**364.0**

Table 4. Present value of tax shields from debt financing

Conclusions

Estimation results from Table 4 are quite different (from 277 to 364 thousands USD). As operational profits are high enough (excepting the first year) and allow interest payments deduction, the company faces only a financial risk, so the second and the third model are not appropriate in this particular case.

If the external financing proceeds from individual investors (bondholders) we can use Benninga and Sarig [1998] assessment model. If an institutional investor (a bank or a leasing company) provides financing, is more appropriate to use APV model of Myers [1974].

Anyway, the two values are close enough (364 thousands USD and 344 thousands USD) and represent about 13% of the project value, if it is entirely financed with equity capital. Because of the low corporate tax rate (16%), the present value of tax shields is only 7% of debt.

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