

Empirical Verification of Depreciation Tax Shield Theory in Conditions of Polish Economy in Transformation

Jolanta Iwin-Garzyńska, Professor
Katedra Finansów, Uniwersytet Szczeciński

Introduction

System transformation of economy is a specific period consisting of two phases: recession, which may be called transformational recession, and post-recessional growth¹. During the period of system transformations economy has a production potential formed for decades in economy different from the economy dominated by market rules and behaviour of entities. That potential is a heritage whose adaptation to new economic conditions determines the length of time and the course of the transformation process. Both general factors characteristic for capitalist countries and distinct factors specifying post-socialistic countries become unique in specific historical and national conditions. Mixture of general, specific and unique factors influence the Polish way to capitalism and its effect, i.e. its final form. The aim of this study has been to verify empirically one of the most important theories of business finances which has already been verified in conditions of capitalistic economy. As a result of that verification unique factors characterizing Polish economy in transformation will be determined. That aim, based on an analysis of relationship between depreciation of fixed assets of Polish enterprises and the level of fixed-capital investments, is the evidence that the theoretical model of DeAngelo and Modigliani cannot be disregarded.

Basic theses of DeAngelo and Masulis theory

Having analysed capital structure factors S. Titman and R. Wessels have found out that the most important of them are: financial leverage, interest-free tax shields and profit variability². As it results from the analysis of publication concerning the factor of financial leverage, enterprises that have a large percentage of fixed assets in kind in the property structure may use outside capital to finance their activity to a greater extent. The reason of it is not a chance of getting higher depreciation capital but the fact that liabilities

¹ J. Kornai: *Transformation Recession*, Budapest 1993.

² Authors have also mentioned other factors, such as development trends, non-typical production, line classification, enterprise size, profitability. In the study factors which are most closely related with depreciation capital have been presented only. See S. Titman, R. Wessels: "Determinants of Capital Structure Choice". *Journal of Finance* 1988, No. 43.

may be secured with fixed assets. That conclusion has been confirmed by A.C. Shapiro³ and Weston and Copeland⁴.

While determining factors forming the capital structure, much attention has been paid to interest-free tax shields, i.e. to depreciation and investment tax credits. Since in Polish income tax systems depreciation is the only interest-free shield, investment tax credits will not be discussed. Research carried out by M. Miller has to be modified because of implementation of interest-free tax shields. It has been modified with conceptions of H. DeAngelo and R. Masulis⁵. Having emphasized the role of interest-free tax shields in selecting an optimal tax strategy those authors have proved that a firm having interest-free tax shields of a big value may have the same value as a firm using high credits and thus having a high interest shield⁶. They have formed five hypotheses to predict changes of capital structure over the course of time. Two of them, i.e. a hypothesis of a tax shield, determining a relationship between the debt ratio and the depreciation tax shield, and a hypothesis of a tax rate that foresees a direct connection between a debt rate and an income tax rate, have caused the most intense discussion. The authors have also proved that a firm selects such debt level that is negatively connected with the value of substitute tax shields. However, a tax depreciation shield is not only a substitute of an interest shield, but also its supplement.

While using the thesis of H. DeAngelo and R. Masulis to analyse a depreciation tax shield a conclusion may be reached that an enterprise which may make higher depreciation deductions should use less outside capital to finance its activity⁷. The higher the value of a depreciation tax shield is, the lower the value of an interest shield gets. That conclusion is supported by R. Masulis, who has found out that if various tax shields are available an optimal capital structure may be achieved by each enterprise and by the whole economy. The optimal capital structure will be reached at such a debt level when the total value of tax, interest and depreciation shields is the maximum amount to be deducted in current taxing conditions⁸. Those hypotheses have been both confirmed and rejected⁹.

³ A.C. Shapiro: *Modern Corporate Finance*. McMillan Publishing Company, New York 1990, p. 469.

⁴ T. Copeland, J.F. Weston: *Financial Theory and Corporate Policy*. Addison—Wesley, Reaging 1988, p. 488.

⁵ H. DeAngelo, R.W. Masulis: "Optimal Capital Structure under Corporate and Personal Taxation". *Journal of Financial Economics*, 1980, No. 8.

⁶ D.R. Emery, J.D. Finnerty: *Principles of Finance with Corporate Applications*. West Publishing Company 1991, p. 436; S.C. Myers: "The Capital Structure Puzzle". *Journal of Finance* 1984, No. 39.

⁷ The objective of the research concerning Polish enterprises discussed in the next parts of this paper is to confirm the thesis resulting from the research of H. DeAngelo and R. Masulis.

⁸ J.D. Martin, S.H. Cox, R.D. McMinn: *The Theory of Finance. Evidence and Applications*. The Dryden Press. Chicago 1988, p. 347.

⁹ Hypotheses resulting from research of H. DeAngelo and R. Masulis have been confirmed by A. Dotan and S.A. Ravid, and rejected by S. Titman and R. Wessels as well as by R.M. Dammon

Many conclusions have not been confirmed in economic practice. Thus further theoretical and empirical research has become necessary and so economic practice has contributed to development of theoretical conceptions, which should be “the image of reality”. Firms with large depreciation shields in relation to expected finance flows should use less outside capital to finance their activity. Since the value of a depreciation tax shield depends on the value of depreciable fixed assets, firms that have a high percentage of assets in kind in the structure of assets and thus have high depreciation deductions should use less outside capital. According to S. Lumba there are other factors that cause a low debt level of an enterprise. Firms do not use a high financial leverage not only due to some significant hidden costs but also because profits resulting from a high debt level are too small¹⁰. S. Titman and S. Tsyplakov¹¹ have mentioned in their studies concerning a dynamic conception of an optimal capital structure in an enterprise that there is a negative relationship between a depreciation rate and a debt rate of the firm and its optimal capital structure. The debt rate usually increases in taxing systems with non-indexed inflation¹², i.e. when erosion of capital occurs. Then the capital decrease is compensated with an increase of the enterprise debt.

Empirical verification of DeAngelo and Masulis theory

In order to verify the DeAngelo and Masulis theory empirically it has been necessary to analyse the effect of a depreciation tax shield on the capital structure of an enterprise, i.e. to find out whether the value of a tax shield affects the capital structure of an enterprise and its debt level. Such an evaluation has been made on the grounds of surveys¹³ and GUS (Central Statistic Office) data.

and L.W. Senbet. S.A. Ravid: “On the Interaction of Real and Financial Decision of the Firm under Uncertainty”. *Journal of Finance* 1988, No. 40; S. Titman, R. Wessels: “The Determinants of Capital Structure Choice”. *Journal of Finance* 1988, No. 43; R.M. Dammon, L.W. Senbet: “The Effect of Taxes and Depreciation on Corporate Investment and financial Leverage”. *Journal of Finance* 1988, No. 43.

¹⁰ S. Lumba: *Investment Appraisal and Financing Decisions*. Chapman and Hall, London 1991, p. 388.

¹¹ S. Titman, S. Tsyplakov: *A Dynamic Model of Optimal Capital Structure*. McCombs School of Business, Department of Finance, University of Texas at Austin, Austin August 29, 2002, p. 24–25.

¹² N.J. Gonedes: “Evidence on the Tax Effects of Inflation Under Historical Cost Accounting Methods”. *Journal of Business* 1981, No. 54; R.S. Hamada: “Financial Theory and Taxation in an Inflationary World: Some Public Policy Issues”. *Journal of Finance* 1985, No. 40; G.N. Mandelker, S.G. Rhee: “The Impact of the Degree of Operating and Financial Leverage on Systematic Risk of Common Stock”. *Journal of Financial and Quantitative Analysis* 1984, No. 19.

¹³ Survey research was carried out within the KBN research project titled “Tax Depreciation Shield and Value of Investments in Kind of Enterprises”, registered with the entry no. 2 H02C 09822. The largest group of analysed enterprises included limited liability companies, and the most numerous group within that one was formed by companies with 50 to 100 employees. Another group consisted of joint stock companies with over 250 employees. Most of analysed enterprises were production companies operating for over 5 years. However, it is really

Values of depreciation tax shields in companies financed with their ownership capital and in indebted enterprises. Values of depreciation tax shields in analysed enterprises according to their capital structure are presented in Table 1.

Table 1.

Value of depreciation tax shield of enterprises according to their capital structure

	1995	1996	1997	1998	1999	2000	2001
Total value of depreciation shield	118,767.32	143,917.84	152,987.70	241,487.70	193,482.08	215,926.82	208,672.39
Firms with ownership capital only	11,339.88	9,753.96	9,534.76	11,791.49	12,039.91	10,584.13	9,790.98
Firms with outside capital	107,427.44	134,163.88	143,452.94	229,696.21	181,442.17	205,342.69	198,881.41

Source: Author's calculations based on surveys.

Data included in Table 1 do not confirm the thesis that enterprises with a depreciation shield of a high value that substitutes an interest shield use debts to a lesser degree. As it results from the table, enterprises whose capital structure includes a debt use depreciation shields to a much greater extent. Thus the thesis that an enterprise increases its debt if the tax system does not index inflation (i.e. if capital erosion occurs) has been confirmed. The loss of capital is compensated with an increase of the enterprise debt or with a reduction of the net profit. However, majority of analysed enterprises with outside capital have used the tax depreciation effect. The tax shield structure is presented at Diagram 1.

Data presented in Diagram 1 confirms the previous conclusions even more clearly. Indebted enterprises use a depreciation tax shield to a greater extent and the percentage of enterprises financed with their ownership capital is only insignificant. It means that enterprises use both a financial leverage and a depreciation shield. It can be concluded from the DeAngelo and Masulis theory that the analysed enterprises expect to increase the enterprise value through tax gains, i.e. reduction of income tax to be paid due to an interest shield and tax depreciation costs. It is also important to describe a relationship between an income tax rate for enterprises and an effective tax rate on the one hand and a depreciation tax shield on the other

difficult to make survey research in Poland, Enterprises do not complete surveys thus protecting their "trade secrets" even if the objective of such surveys is to verify facts that are significant for the enterprises themselves. The common opinion of Polish enterprises is that tax burdens are too heavy. On the other hand, legislative and executive authorities declare that current and expected solutions concerning income tax and depreciation of fixed assets should reduce the tax burden and stimulate enterprises to undertake investments in kind. However, enterprises are not interested in empirical verification of those opinions

hand in connection with the gross financial balance. The data is presented in Table 2.

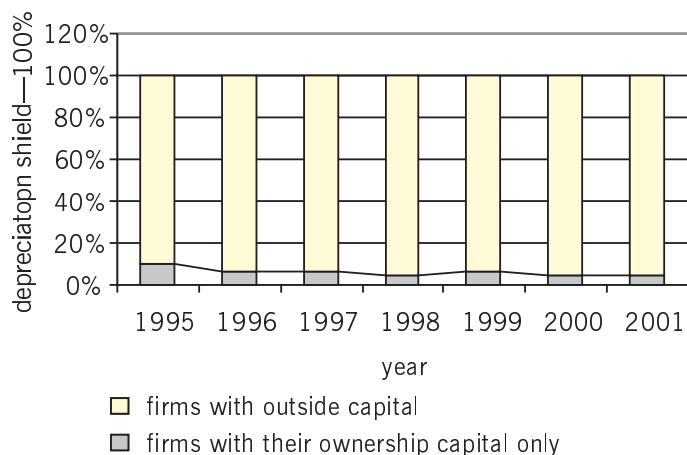


Diagram 1.

Structure of depreciation tax shield in analysed enterprises

Source: Author's study based on Table 1.

Table 2.

Effective tax rate, depreciation shield and depreciation in connection with gross financial balance of analysed enterprises [%]

	1995	1996	1997	1998	1999	2000	2001
Income tax rate	40	40	38	36	34	30	28
Average effective tax rate	29.12	35.2	34.3	17.1	31.1	20.8	27.2
Percentage of firms with gross loss	10	12	5	17	22	24	29
Depreciation tax shield as percentage of gross financial balance	25	53	65	64	36	91	81
Depreciation value divided by gross profit	64	132	172	179	106	303	288
Percentage of depreciation in cash-flow	48	68	77	77	119	87	106
Value of depreciation divided by investment value	96	106	68	113	74	99	90
Scope of application of tax facilitations by enterprises (balance depreciation-tax depreciation)/balance depreciation	2	3	3	2	8	2	2

Source: Author's calculations based on surveys

As it results from Table 2, an average effective tax rate of analysed enterprises is lower than the value specified in the corporate income tax act. It means that some of the analysed firms have a negative financial balance and do not pay income tax. A percentage of those analysed firms that have a gross loss has been increasing since 1998 reaching the value of 29 in 2001. It means

that nearly 30% of the analysed enterprises have not paid income tax so they have not been interested in increasing costs or in the range of the depreciation tax shield. As it results from Table 2, the scope of application of tax facilitations is 2–3% and it reached 8% in 1998 only because the percentage of the tax depreciation shield in the gross financial balance was low then.

The research does not confirm the thesis that enterprises with a depreciation shield of a high value, as substitute of interest shield, use debts to a lower degree. Enterprises whose capital structure includes a debt use depreciation shields to a much greater extent. Thus the thesis that an enterprise increases its debt if the tax system does not index inflation (i.e. if capital erosion occurs) has been confirmed. Large majority of analysed enterprises are those firms with outside capital that have used the tax depreciation effect.

On the grounds of presented survey results some specific relationships between a depreciation tax shield and a capital structure of Polish enterprises may be specified. It is important to check whether relationships found in the analysed enterprises are confirmed by GUS (Central Statistic Office). Data concerning value of investment expenditures, debt depreciation and financial balance of enterprises in accordance with their ownership form has been presented in Table 3¹⁴.

Table 3.

Investment expenditures, depreciation, liabilities and financial balance of enterprises in accordance with their ownership form in 1995–2001 (millions of zlotys, current prices)

	Sector	1995	1996	1997	1998	1999	2000	2001
Investment expenditures	Total	31,778	44,862	47,586	61,715	66,166	70,930	56,560
	Public	19,115	25,346	24,645	26,214	25,610	23,611	15,756
	Private	12,663	19,516	22,941	35,502	40,556	47,319	40,803
Depreciation	Total	13,240	16,906	20,384	28,404	32,504	39,225	42,874
	Public	9,571	11,881	12,301	16,634	17,367	18,624	15,221
	Private	3,669	5,025	8,083	11,770	15,138	20,600	27,653
Total liabilities	Total	86,731	111,793	148,107	205,225	255,622	179,044	210,540
	Public	60,002	71,757	78,517	105,890	115,128	88,162	94,260
	Private	26,729	40,036	69,590	99,336	140,495	90,882	116,280
Long-term liabilities	Total	31,856	39,013	51,338	74,864	97,809	111,814	134,909
	Public	20,500	22,896	26,555	33,514	38,595	40,727	47,843
	Private	11,355	16,117	24,783	41,350	59,214	71,087	87,066

¹⁴ Presented data concerns enterprises from the following sectors: mining, production, building, trade and repairs, hotels and restaurants, transport and stock management in accordance with their form of ownership in 1995–2001 (millions of zlotys)

	Sector	1995	1996	1997	1998	1999	2000	2001
Gross financial balance	Total	16,544	16,935	22,161	13,758	8,504	18,456	7,664
	Public	10,970	7,654	8,305	853	-3,334	1,450	-3,334
	Private	5,575	9,280	13,856	12,906	11,838	17,006	10,998

Source: Financial balances of economic entities I–XII, 1995–2001, GUS, Warsaw.

As it results from Table 3, investment expenditures of the analysed enterprises increased to the end of year 2000. Since 2001 the value of expenditures has decreased. Investment expenditures in the group of public enterprises have been decreasing since 1999 and in the group of private enterprises—since 2001. The business recession in Poland and in the world in 1998 affected weaker entities, i.e. public enterprises, more than private firms, which were sounder and better managed so were able to keep the investment increase till 2001. Values of enterprise investments have been affected by the financing sources. A depreciation value, defined as the amount of capital released from fixed assets, was increasing in the whole analysed period but it was lower than the value of used investments expenditures. In the public sector the depreciation value was lower and in 2001 it nearly reached the value of investment expenditures. It means that by 2001 public enterprises supported investment resources with a debt (mainly long-term liabilities) and in they 2001 financed investments only with means from depreciation. Long-term liabilities, whose value in that group of enterprises was increasing during the whole analysed period, financed the negative gross financial balance in 2001. The value of depreciation means in the group of private enterprises was increasing during the whole period although investment expenditures in 2001 decreased. However, together with the increase of depreciation and a positive gross financial balance in that group of firms the value of long-term liabilities increased. Their value and the value of depreciation and gross income exceed significantly the value of investments that were made. It means that the constant capital in those enterprises was used not for investments but for other objectives, i.e. for financing current assets.

Due to limited capital Polish enterprises had to find outside capital to finance investments in kind, which resulted in changing of capital structure of the enterprises. Values of long-term liabilities of the analysed enterprises have been presented in Diagram 2.

As it results from data presented in Diagram 3, long-term debts of analysed enterprises tended to increase. The results support the thesis that enterprises with fixed assets of a great value (i.e. with high depreciation deductions) use long-term debts for financing their investments to a greater extent. On the other hand, the hypothesis of DeAngelo and Masulis that firms using a high-value depreciation shield use an interest shield to a lower degree cannot be confirmed. Stabilization of the debt level of public enterprises can also be noticed on the diagram. As own company means in those enterprises

decreased and financial balance was poor, it means that investments expenditures decreased and fixed assets got decapitalized.

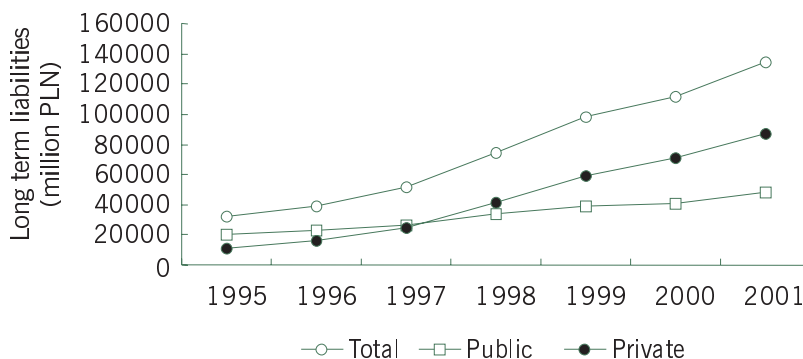


Diagram 2.

Value of long-term liabilities of Polish enterprises in 1995–2001 in accordance with ownership sectors (millions of zlotys, current prices)

Source: Based on Table 3.

Erosion of means coming from depreciation deductions caused by inflation and taxes is compensated with means obtained as a result of tax depreciation shield. The value of tax depreciation shield for the analysed enterprises has been presented in Table 4.

Table 4.

Value of tax depreciation shield¹⁵ for enterprises from the following sectors: mining, production, building, trade and repairs, hotels and restaurants, transport and stock management in accordance with forms of ownership in 1995–2001 (millions of zlotys)

Variable		Sector	1995	1996	1997	1998	1999	2000	2001
Tax depreciation shield	X1	Total	5,296	6,762	7,746	10,225	11,051	11,768	12,005
	X2	Public	3,828	4,752	4,674	5,988	5,905	5,587	4,262
	X3	Private	1,468	2,010	3,072	4,237	5,146	6,181	7,743

Source: calculations by Institute of Economic Analyses, Diagnoses and Forecasts in Szczecin on the grounds of Table 3.

As it results from Table 4, the value of tax depreciation shield of the analysed enterprises increased although corporate income tax rates decreased. Just in public enterprises that tax shield value decreased in 2001 which is the result of the drop of the depreciation value.

¹⁵ The value of the tax shield included in the analysis which is the result of the equation: $PT = A \times T$ has been determined on the grounds of the survey research. As it results from the research the difference between tax depreciation and balance depreciation is about 2%. That is why the tax shield value has been calculated on the grounds of balance depreciation.

As it results from the surveys the tax depreciation shield does not affect the capital structure of enterprises, i.e. larger tax savings coming from the tax depreciation effect do not reduce debts of the enterprises. Those enterprises that use the tax depreciation shield use also a debt, i.e. the interest tax shield. Models of relationship between the tax depreciation shield and long-term liabilities of the analysed enterprises in accordance with their sectors of ownership have been presented in Table 5.

Table 5.

Models of relationship between long-term liabilities and tax depreciation shield of analysed enterprises in accordance with their forms of ownership

	long-term liabilities—public sector (X_{11})	long-term liabilities—private sector (X_{12})
tax depreciation shield—public sector (X_{14})	$\hat{X}_{11} = 11175.5 + 4.35 X_{14}$ (25375.8) (5.02) $R^2 = 0.13$ $S_e = 10309.0$	
tax depreciation shield—private sector (X_{13})		$\hat{X}_{12} = -9762.5 + 12.7 X_{13}$ (2821.7) (0.594) $R^2 = 0.99$ $S_e = 3297.9$

Source: calculations by Institute of Economic Analyses, Diagnoses and Forecasts in Szczecin on the grounds of Table 3 (there are mean errors of estimation of structural parameters in brackets).

The models presented in Table 5, confirm results of the surveys and earlier conclusions concerning the situation of Polish public enterprises. The model explains the relationship in 13% in a public enterprise and both structural parameters are statistically insignificant. It is another proof that enterprises from that group are not able to use properly their depreciation capital and long-term liabilities to finance investment activity. The increase of the tax depreciation shield by 1 million zlotys in the private sector resulted in an average increase of long-term liabilities by 12.7 million zlotys. The model is well adapted to real conditions ($R = 0.99$), which confirms that both the model and the analysed relationships are true. The thesis resulting from the research of DeAngelo and Masulis has not been confirmed in public enterprises; however, it has been found true that high depreciation deductions resulting from higher investment expenditures in private enterprises are not sufficient for financing their development. As it results from the presented models, tax savings coming from depreciation do not reduce debts of enterprises. The same conclusion has been made on the grounds of the analysis of the survey results. The following conclusion can be formulated: in the Polish tax system that does not compensate inflation effects enterprises get indebted as a result of a decrease of a real value of the depreciation capital. Due to two factors: inflation and income tax the real value of the company capital is not sufficient for appropriate restitution of assets in kind.

Final conclusions

It is necessary to emphasise that all achieved results confirm the usefulness of the research and its subject. The thesis is that factors typical in capitalist countries become specific and unique in post-socialist countries. Mixture of general, specific and unique factors makes the fundamental market economy theories change in conditions of economy in transformation. Due to inflation and tax erosion of capital and because Polish enterprises do not use accelerated methods of depreciation the value of capital is not sufficient for financing investments in kind. As a result of the research the difficult situation of public enterprises concentrated on current activities has been described. The specificity of Polish economy is the result of the significant percentage of public enterprises in the business structure.

The research has confirmed that the group of public enterprises do not properly use their long-term liabilities to finance investment activity. However, in the private sector the increase of the tax depreciation shield by 1 million zlotys has caused an average increase of long-term liabilities by 12.7 million zlotys. The thesis resulting from the research by DeAngelo and Masulis has not been confirmed in private enterprises but the thesis is that high depreciation deductions resulting from higher investment expenditures of private enterprises are not sufficient for financing their development. The following conclusion can be formulated: Polish enterprises are in the chronic shortage of capital.

The problem of the capital structure is fundamental in forming a modern conception of corporate finance. It is still being explored by theoreticians of that specialization. In Poland that problem is raising more and more interest among scientists and practitioners. However, no research has been carried out yet to adapt the theory and to emphasize specific features of Polish economy in transformation.