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A COMPARATIVE ANALYSIS OF THE BALANCE SHEET VALUATION OF SHARES 250 PLUS AND 5 PLUS LISTED COMPANIES – BASED ON FAIR VALUE IN ACTIVE MARKETS AND ESTIMATED ON THE BASIS OF ECONOMIC AND FINANCIAL MODELS

Financial instruments pose a number of problems in economic sciences, especially in accountancy which deals with continuous measurements of these instruments in practice. One of the major problems which is the use of fair value is valuating financial instruments. According to this category, two basic financial instruments can be identified – instruments which price is determined by active markets and those for which such price and markets do not exist. The first class is valuated on the basis of accounting categories while the second type of instruments is valuated on the basis of value estimation models and techniques. The paper presents the models for balance sheet valuation of shares based on fair value in active markets estimated on the basis of economic and financial models. The paper aims to present the results of empirical research on the basis of statistical methods and attempts to identify economic and financial models which brings the valuation of 250+ and 5+ companies closest to the actual fair value in the Polish economic reality.

Keywords: *accounting, financial instruments, fair value, balance sheet valuation, shares.*

Introduction

The major objective of the paper is to present a comparison, based on statistical methods, between balance sheet valuations of shares estimated on the basis of economic and financial models and their fair value determined in active markets. Most controversial issues relate to the category of fair value. The introduction of the concept of fair value divides shares into two basic categories – the shares whose prices are determined in active markets and the shares for which such prices and markets do not exist. This new accounting economic category, a substitute of market value, does not only refer to market transactions – as is commonly believed – but also to appropriate methods and expert opinions. In the future the category of fair value is likely to become a general valuation principle and replace the historical cost principle.

The paper presents the concepts of share valuation based on general accounting principles, focusing on fair value in active markets and share value estimations based on economic and financial models. Balance sheet valuation of shares is based on selected models: DCF (*Discounted Cash Flow*), CAPM (*Capital Asset Pricing Model*) and HEV (*Historical Exchange Value*).

The last part of the paper refers to statistical methods to assess balance sheet valuations of listed shares representing two segments: 250+ companies (with capitalization exceeding EUR 250m) and 5+ (with capitalization ranging from EUR 5m to EUR 50m) from the point of view of their practical applications.

Balance sheet valuation of shares at fair value in active markets

The contemporary accounting standards accept two basis methods for valuating financial instruments: historical costs and fair value. Historical costs constitute a basis for valuations in all accounting standards, and the application of international standards suggests that historical costs represent the most frequently applied method in preparing financial statements [1]. It implies that financial instruments are valuated on the basis of mixed models.

Mixed valuation models originate from the need to find an alternative valuation concept which could replace the fundamental principle of historical costs. Accounting theoreticians share the view that valuation should be based on historical costs and value [2, 3, 4]. However, the problem is which concept of value should be chosen: fair value, market value, utility value, present value, economic value, or another category of value? The choice is fair value.

The original reason for introducing fair value was to bring the measurement of economic categories in financial statements closer to the level of their actual value. This new economic category, a substitute of market value, does not only refer to the context of market transactions but also to valuations based on appropriate methods or techniques and expert opinions. According to this economic category, two basic types of shares are those traded in active markets and those for which prices and markets do not exist. The most reliable fair value is determined by an active market. However, when share valuation cannot rely on prices quoted by active markets (such prices do not exist), share valuation is based on fair value estimation with the use of different valuation methods and techniques.

Shares are originally recorded at fair value. This category ensures the stability of balance sheet items, while continuous adjustments of fair value and referring them directly to profits and losses hinder the current monitoring of revenues. Following the initial recording, shares continue to be recorded at fair value, and if they are held by a business entity until the time of preparing financial statements, they are evaluated at fair value at the date of the balance sheet. When changes in fair value are determined by active markets, this category does not pose any practical problems to the valuation process [5, pp. 67-81; 6, pp. 67-81; 7, pp. 98-110].

Balance sheet valuations in the paper are based on the shares of small (5+) and large (250+) listed companies, and they are classified as financial assets at fair value with changes in P/L Account. This classification implies that shares are recorded at fair value at the balance sheet date (at year-end), based on active market prices. Balance sheet valuations are presented in Table 1.

Table 1. **Balance sheet valuations – 5 Plus and 250 Plus companies at fair value at year-end, active market prices (PLN)**

Date	Vistula	Mostostal Zabrze	Mostostal export	Bytom	Próchnik	BRE	KGHM	BPH	ING Bank Śląski	Millennium
31.12.1998	9.65	13.00	4.15	4.50	9.15	84.00	12.50	208.00	182.00	3.15
31.12.1999	15.00	12.55	4.49	7.30	4.15	133.50	26.20	200.00	281.00	12.80
31.12.2000	8.35	9.00	5.00	4.51	1.76	131.00	25.80	235.00	235.00	6.70
31.12.2001	6.05	6.70	2.42	1.10	0.46	118.00	13.00	230.00	319.00	2.75
31.12.2002	2.00	1.23	1.23	0.99	0.21	88.00	13.50	271.50	383.00	3.30
31.12.2003	5.10	0.61	1.04	3.40	0.55	92.50	26.20	355.00	345.00	2.55
31.12.2004	31.00	0.83	1.39	13.20	1.40	114.00	31.30	510.00	389.00	3.36
31.12.2005	37.90	1.54	1.47	13.40	1.61	169.00	62.50	750.50	564.00	5.25
31.12.2006	90.00	4.11	2.89	20.20	0.86	336.00	89.00	926.50	768.00	7.95
31.12.2007	11.98	8.00	4.18	3.72	0.91	505.00	105.80	104.00	725.00	11.63
31.12.2008	2.16	3.00	1.86	1.22	0.48	196.50	28.12	35.20	430.00	2.88
31.12.2009	2.27	3.96	1.70	0.78	0.45	260.00	106.00	84.00	780.00	4.80
31.12.2010	2.11	2.80	1.25	1.15	0.70	304.00	173.00	71.00	894.00	4.90
31.12.2011	0.81	1.28	0.67	0.65	0.28	246.00	110.60	31.70	78.60	3.80

Source: author's calculations.

Balance sheet valuations – the shares of 5 Plus companies

The estimation of values of shares issued by 5 Plus companies is based on 3 economic and financial models: DCF [8, 9, 10], HEV [11, 12] and CAPM [13, 14, 15].

Fair value estimations with the use of DCF, HEV and CAPM models are based on share prices recorded in the period of 14 years (1998-2011) on a monthly basis (for each company t = 168 observations). Fair value is estimated on the basis of 5 listed companies: Vistula, Mostostal Zabrze, Mostostal export, Bytom and Próchnik. Balance sheet valuations at fair value based on economic and financial models are performed at the end of each analysed year (from 31.12.1998 to 31.12.2011). The estimations in this period are also based on the following indicators: WIG annual returns, WIG20 annual returns, average monthly increase in WIG returns, average monthly increase in WIG20 returns, annual inflation rates and annual risk-free returns.

The first model for estimating the fair value of listed shares is based on DCF. The model is used in 6 variants. The cash flow discounting factors are as follows: WIG annual returns, WIG20 annual returns, average monthly increase in WIG returns and average monthly returns in WIG20, annual risk-free returns and annual inflation rates. The results of estimated balance sheet valuations based on DCF are presented in Tables 2-4.

Table 2**. Estimated share values, 5 Plus companies based on DCF according to annual WIG and based on DCF according to annual WIG20 (PLN)**

Method	DCF – annual WIG					DCF - annual WIG20				
Date	Vistula	Mostostal Zabrze	Mostostal export	Bytom	Próchnik	Vistula	Mostostal Zabrze	Mostostal export	Bytom	Próchnik
31.12.1998	7.67	16.65	6.75	14.02	12.36	7.24	15.72	6.37	13.23	11.66
31.12.1999	13.64	18.37	5.87	6.36	12.93	13.91	18.73	5.98	6.48	13.19
31.12.2000	14.80	12.39	4.43	7.20	4.10	15.23	12.74	4.56	7.41	4.21
31.12.2001	6.51	7.02	3.90	3.52	1.37	5.56	5.99	3.33	3.00	1.17
31.12.2002	6.24	6.91	2.50	1.14	0.47	5.89	6.52	2.35	1.07	0.45
31.12.2003	2.90	1.78	1.78	1.43	0.30	2.68	1.65	1.65	1.33	0.28
31.12.2004	6.52	0.78	1.33	4.35	0.70	6.35	0.76	1.30	4.23	0.69
31.12.2005	41.43	1.11	1.86	17.64	1.87	41.98	1.12	1.88	17.88	1.90
31.12.2006	53.67	2.18	2.08	18.97	2.28	46.90	1.91	1.82	16.58	1.99
31.12.2007	99.35	4.54	3.19	22.30	0.95	94.67	4.32	3.04	21.25	0.90
31.12.2008	5.86	3.91	2.05	1.82	0.45	6.20	4.14	2.16	1.93	0.47
31.12.2009	3.17	4.41	2.73	1.79	0.70	2.88	4.00	2.48	1.63	0.64
31.12.2010	2.70	4.70	2.02	0.93	0.53	2.61	4.55	1.95	0.90	0.52
31.12.2011	1.67	2.22	0.99	0.91	0.55	1.65	2.19	0.98	0.90	0.55

Source: author's calculations.

Table 3. **Estimated share values - 5 Plus companies, DCF according to average monthly increase in WIG annual returns and average monthly increase in WIG20 annual returns (PLN)**

Method	DCF – average monthly increase in annual WIG					DCF – average monthly increase in annual WIG20				
Date	Vistula	Mostostal Zabrze	Mostostal export	Bytom	Próchnik	Vistula	Mostostal Zabrze	Mostostal export	Bytom	Próchnik
31.12.1998	7.57	16.44	6.66	13.84	12.20	7.38	16.02	6.49	13.49	11.89
31.12.1999	13.64	18.37	5.87	6.36	12.93	13.91	18.73	5.98	6.48	13.19
31.12.2000	14.80	12.39	4.43	7.20	4.10	15.23	12.74	4.56	7.41	4.21
31.12.2001	6.51	7.02	3.90	3.52	1.37	5.56	5.99	3.33	3.00	1.17
31.12.2002	6.24	6.91	2.50	1.14	0.47	5.89	6.52	2.35	1.07	0.45
31.12.2003	2.90	1.78	1.78	1.43	0.30	2.68	1.65	1.65	1.33	0.28
31.12.2004	6.52	0.78	1.33	4.35	0.70	6.35	0.76	1.30	4.23	0.69
31.12.2005	41.43	1.11	1.86	17.64	1.87	41.98	1.12	1.88	17.88	1.90
31.12.2006	53.67	2.18	2.08	18.97	2.28	46.90	1.91	1.82	16.58	1.99
31.12.2007	99.35	4.54	3.19	22.30	0.95	94.67	4.32	3.04	21.25	0.90
31.12.2008	5.86	3.91	2.05	1.82	0.45	6.20	4.14	2.16	1.93	0.47
31.12.2009	3.17	4.41	2.73	1.79	0.70	2.88	4.00	2.48	1.63	0.64
31.12.2010	2.70	4.70	2.02	0.93	0.53	2.61	4.55	1.95	0.90	0.52
31.12.2011	1.67	2.22	0.99	0.91	0.55	1.65	2.19	0.98	0.90	0.55

Source: author's calculations.

Table 4. **Estimated share values – 5 Plus companies, based on DCF according to annual risk-free returns, and DCF according to annual inflation (PLN)**

Method	DCF – annual risk-free returns					DCF – annual inflation				
Date	Vistula	Mostostal Zabrze	Mostostal export	Bytom	Próchnik	Vistula	Mostostal Zabrze	Mostostal export	Bytom	Próchnik
31.12.1998	9.95	21.60	8.75	18.19	16.03	9.50	20.63	8.36	17.38	15.31
31.12.1999	10.70	14.42	4.60	4.99	10.15	10.60	14.27	4.56	4.94	10.05
31.12.2000	17.25	14.43	5.16	8.40	4.77	16.28	13.62	4.87	7.92	4.50
31.12.2001	9.55	10.29	5.72	5.16	2.01	8.65	9.32	5.18	4.67	1.82
31.12.2002	6.54	7.24	2.61	1.19	0.50	6.10	6.75	2.44	1.11	0.46
31.12.2003	2.10	1.29	1.29	1.04	0.22	2.03	1.25	1.25	1.01	0.21
31.12.2004	5.43	0.65	1.11	3.62	0.59	5.32	0.64	1.09	3.55	0.57
31.12.2005	32.50	0.87	1.46	13.84	1.47	31.22	0.84	1.40	13.29	1.41
31.12.2006	39.45	1.60	1.53	13.95	1.68	38.43	1.56	1.49	13.59	1.63
31.12.2007	93.99	4.29	3.02	21.09	0.90	93.60	4.27	3.01	21.01	0.89
31.12.2008	12.68	8.47	4.43	3.94	0.96	12.38	8.26	4.32	3.84	0.94
31.12.2009	2.27	3.15	1.96	1.28	0.50	2.24	3.11	1.93	1.26	0.50
31.12.2010	2.36	4.13	1.77	0.81	0.47	2.34	4.08	1.75	0.80	0.46
31.12.2011	2.20	2.92	1.31	1.20	0.73	2.21	2.93	1.31	1.20	0.73

Source: author's calculations.

The second method for estimating the fair value of shares is based on the CAPM model which expresses the expected return on shares as a sum of return on risk-free assets and a risk premium.

CAPM is applied in two variants. The first one assumes that the market rate of return is based on the WIG index, i.e. the entire market. The second variant of CAPM is based on WIG20 returns.

Considering the two above defined approaches to market returns and risk-free returns, CAPM is used to estimate expected returns and the value of listed shares at the end of each year (1998-2011). Risk-free returns are represented by annual interest rates of treasury bonds. The results of estimates based on CAPM for WIG and WIG20 indices are presented in the Table below.

The third model for estimating the fair value of listed shares is based on the historical exchange value. The HEV model is based on an analysis of historical trends in actual share prices determined on the basis of exponential smoothing. Fair value estimations are based on two filtration factors: inflation rates and risk-free rate of return. Assuming that smoothing coefficient α is dependent on inflation rates and risk-free rates of return, balance sheet valuations of shares are performed for the analysed period. The results are presented in Table 6.

Estimated balance sheet values for 250 Plus companies

The estimations of the share values of 250+ companies are based on the same economic and financial models: DCF, CAPM and HEV. Calculations are based on quotations in the period of 14 years (1998-2011) on a monthly basis (for each company t = 168 observations). Fair value is estimated for 5 listed companies: BRE, KGHM, BPH, ING Bank Śląski and Millennium. Balance sheet valuations at fair value with the use of DCF, CAPM and HEV models are performed at year-end (31.12.1998 - 31.12.2011).

The first applied model for fair value estimations is DCF. The model is used in 6 variants. Cash flows are discounted in the following order: WIG annual returns, WIG20 annual returns, monthly average increase in WIG returns, monthly average increase in WIG20 returns, annual risk-free rates

and annual inflation. Balance sheet estimations based on DCF are presented in Tables 7-9.

Table 5. **Estimated share values – 5 Plus companies, CAPM according to annual WIG and annual WIG20 (PLN)**

Method	CAPM – annual WIG					CAPM – annual WIG20				
Date	Vistula	Mostostal Zabrze	Mostostal export	Bytom	Próchnik	Vistula	Mostostal Zabrze	Mostostal export	Bytom	Próchnik
31.12.1998	(-)	9.96	5.82	2.29	6.66	(-)	6.88	5.04	(-)	4.18
31.12.1999	25.72	23.72	6.45	10.21	17.25	28.12	25.21	6.75	11.05	18.39
31.12.2000	4.73	9.62	4.09	3.85	3.05	6.27	10.21	4.22	4.41	3.26
31.12.2001	(-)	2.60	3.06	(-)	0.38	(-)	(-)	2.00	(-)	(-)
31.12.2002	5.04	6.48	2.44	0.99	0.44	3.00	5.44	2.21	0.71	0.36
31.12.2003	6.17	2.44	2.01	2.54	0.43	5.23	2.18	1.84	2.19	0.38
31.12.2004	11.03	0.96	1.43	6.40	0.89	10.44	0.93	1.40	6.11	0.86
31.12.2005	78.23	1.43	2.04	28.35	2.50	84.09	1.51	2.12	30.22	2.63
31.12.2006	112.20	2.96	2.34	33.12	3.22	79.98	2.36	1.98	24.63	2.53
31.12.2007	121.43	4.87	3.27	25.69	1.03	97.72	4.37	3.05	21.72	0.92
31.12.2008	(-)	(-)	0.94	(-)	(-)	(-)	(-)	0.91	(-)	(-)
31.12.2009	6.88	6.10	3.09	3.22	1.02	5.60	5.28	2.78	2.68	0.87
31.12.2010	4.06	5.49	2.13	1.25	0.64	3.69	5.19	2.05	1.15	0.60
31.12.2011	(-)	1.26	0.84	0.09	0.28	(-)	1.08	0.79	(-)	0.23

(-) – Estimated balance sheet valuation based on the adopted method assumes negative values.
Source: author's research.

Table 6. **Estimated share values – 5 Plus companies, HEV according to annual inflation and annual risk-free rates (PLN)**

Method	HEV – annual inflation					HEV – annual risk-free rate				
Date	Vistula	Mostostal Zabrze	Mostostal export	Bytom	Próchnik	Vistula	Mostostal Zabrze	Mostostal export	Bytom	Próchnik
31.12.1998	8.89	18.05	7.14	14.18	13.32	8.97	17.56	6.85	13.23	12.91
31.12.1999	10.61	12.92	4.21	5.00	8.26	10.70	12.91	4.22	5.05	8.16
31.12.2000	13.96	11.99	4.57	6.86	3.78	13.27	11.62	4.62	6.57	3.53
31.12.2001	8.19	8.84	4.82	4.27	1.67	7.77	8.42	4.35	3.66	1.43
31.12.2002	5.99	6.61	2.40	1.10	0.46	5.45	5.89	2.24	1.08	0.42
31.12.2003	2.10	1.21	1.22	1.07	0.22	2.31	1.17	1.21	1.23	0.24
31.12.2004	7.28	0.63	1.07	4.23	0.62	8.26	0.64	1.08	4.59	0.65
31.12.2005	31.10	0.84	1.39	13.20	1.40	31.64	0.90	1.40	13.22	1.42
31.12.2006	39.34	1.61	1.51	13.59	1.59	42.00	1.74	1.58	13.94	1.55
31.12.2007	84.00	4.41	2.99	18.93	0.86	83.38	4.44	3.00	18.80	0.86
31.12.2008	11.35	7.68	4.03	3.56	0.88	10.89	7.44	3.92	3.44	0.86
31.12.2009	2.17	3.06	1.85	1.19	0.48	2.17	3.09	1.84	1.18	0.48
31.12.2010	2.26	3.89	1.67	0.80	0.47	2.26	3.87	1.66	0.81	0.47
31.12.2011	2.00	2.67	1.20	1.11	0.66	2.00	2.67	1.20	1.11	0.66

Source: author's calculations.

Table 7. **Estimated share values – 250 Plus companies, DCF according to annual WIG and annual WIG20 (PLN)**

Method	DCF – annual WIG					DCF - annual WIG20				
Date	BRE	KGHM	BPH	ING Bank Śląski	Millennium	BRE	KGHM	BPH	ING Bank Śląski	Millennium
31.12.1998	67.91	9.99	176.14	192.79	3.02	64.10	9.43	166.25	181.97	2.85
31.12.1999	118.71	17.67	293.96	257.21	4.45	121.05	18.01	299.73	262.27	4.54
31.12.2000	131.76	25.86	197.39	277.33	12.63	135.56	26.60	203.09	285.33	13.00
31.12.2001	102.19	20.13	183.31	183.31	5.23	87.16	17.17	156.35	156.35	4.46
31.12.2002	121.77	13.42	237.34	329.18	2.84	114.81	12.65	223.78	310.37	2.68
31.12.2003	127.53	19.56	393.46	555.04	4.78	117.82	18.07	363.51	512.79	4.42
31.12.2004	118.34	33.52	454.17	441.38	3.26	115.21	32.63	442.18	429.72	3.18
31.12.2005	152.37	41.83	681.64	519.92	4.49	154.38	42.39	690.63	526.77	4.55
31.12.2006	239.31	88.50	1062.73	798.64	7.43	209.14	77.34	928.74	697.95	6.50
31.12.2007	370.90	98.25	1022.74	847.78	8.78	353.44	93.62	974.60	807.87	8.36
31.12.2008	247.09	51.77	50.89	354.74	5.69	261.52	54.79	53.86	375.44	6.02
31.12.2009	288.57	41.29	51.69	631.47	4.23	262.26	37.53	46.98	573.91	3.84
31.12.2010	308.79	125.89	99.76	926.38	5.70	298.69	121.77	96.50	896.07	5.51
31.12.2011	240.66	136.96	56.21	707.74	3.88	237.57	135.19	55.48	698.63	3.83

Source: author's calculations.

Table 8. **Estimated share values – 250 Plus companies, DCF according to average monthly increase in WIG and average monthly increase in WIG20 (PLN)**

Method	DCF – average monthly increase in WIG					DCF – average monthly increase in WIG20				
Date	BRE	KGHM	BPH	ING Bank Śląski	Millennium	BRE	KGHM	BPH	ING Bank Śląski	Millennium
31.12.1998	67.04	9.86	173.88	190.32	2.98	65.34	9.61	169.46	185.48	2.91
31.12.1999	118.71	17.67	293.96	257.21	4.45	121.05	18.01	299.73	262.27	4.54
31.12.2000	131.76	25.86	197.39	277.33	12.63	135.56	26.60	203.09	285.33	13.00
31.12.2001	102.19	20.13	183.31	183.31	5.23	87.16	17.17	156.35	156.35	4.46
31.12.2002	121.77	13.42	237.34	329.18	2.84	114.81	12.65	223.78	310.37	2.68
31.12.2003	127.53	19.56	393.46	555.04	4.78	117.82	18.07	363.51	512.79	4.42
31.12.2004	118.34	33.52	454.17	441.38	3.26	115.21	32.63	442.18	429.72	3.18
31.12.2005	152.37	41.83	681.64	519.92	4.49	154.38	42.39	690.63	526.77	4.55
31.12.2006	239.31	88.50	1062.73	798.64	7.43	209.14	77.34	928.74	697.95	6.50
31.12.2007	370.90	98.25	1022.74	847.78	8.78	353.44	93.62	974.60	807.87	8.36
31.12.2008	247.09	51.77	50.89	354.74	5.69	261.52	54.79	53.86	375.44	6.02
31.12.2009	288.57	41.29	51.69	631.47	4.23	262.26	37.53	46.98	573.91	3.84
31.12.2010	308.79	125.89	99.76	926.38	5.70	298.69	121.77	96.50	896.07	5.51
31.12.2011	240.66	136.96	56.21	707.74	3.88	237.57	135.19	55.48	698.63	3.83

Source: author's calculations.

Table 9. **Estimated share values – 250 Plus companies, DCF according to annual risk-free rate and annual inflation (PLN)**

Method	DCF – annual risk-free rate					DCF – annual inflation				
Date	BRE	KGHM	BPH	ING Bank Śląski	Millennium	BRE	KGHM	BPH	ING Bank Śląski	Millennium
31.12.1998	88.09	12.96	228.48	250.07	3.92	84.17	12.38	218.29	238.92	3.75
31.12.1999	93.18	13.87	230.73	201.89	3.49	92.23	13.73	228.38	199.84	3.46
31.12.2000	153.53	30.13	230.00	323.15	14.72	144.85	28.43	217.00	304.89	13.89
31.12.2001	149.77	29.50	268.68	268.68	7.66	135.72	26.73	243.46	243.46	6.94
31.12.2002	127.48	14.04	248.47	344.62	2.97	118.94	13.10	231.84	321.55	2.77
31.12.2003	92.58	14.20	285.62	402.92	3.47	89.50	13.73	276.12	389.51	3.36
31.12.2004	98.50	27.90	378.04	367.39	2.72	96.57	27.35	370.62	360.18	2.66
31.12.2005	119.51	32.81	534.63	407.79	3.52	114.80	31.52	513.57	391.72	3.38
31.12.2006	175.93	65.06	781.27	587.12	5.47	171.37	63.38	761.01	571.90	5.32
31.12.2007	350.88	92.94	967.54	802.02	8.30	349.44	92.56	963.56	798.72	8.27
31.12.2008	534.69	112.02	110.12	767.63	12.31	521.67	109.29	107.43	748.93	12.01
31.12.2009	206.62	29.57	37.01	452.15	3.03	203.38	29.10	36.43	445.05	2.98
31.12.2010	270.84	110.42	87.50	812.53	5.00	268.06	109.29	86.60	804.18	4.95
31.12.2011	317.56	180.72	74.17	933.87	5.12	317.98	180.96	74.27	935.12	5.13

Source: author's calculations.

Another method for fair value estimations is based on CAPM. The model is used in two variants. The first one assumes that the marker rate of return is based on WIG, i.e. the entire market, while the other variant of CAPM is based on WIG20 returns.

Considering the two above defined approaches to market returns and risk-free returns, CAPM is used to estimate expected returns and the value of listed shares at the end of each year (1998-2011). The results of estimates based on CAPM for WIG and WIG20 indices are presented in the Table below.

Table 10. **Estimated share values – 250 Plus companies, CAPM according to annual WIG and WIG20 (PLN)**

Method	CAPM – annual WIG					CAPM – annual WIG20				
Date	BRE	KGHM	BPH	ING Bank Śląski	Millennium	BRE	KGHM	BPH	ING Bank Śląski	Millennium
31.12.1998	61.06	4.36	131.80	167.53	1.17	53.92	2.09	106.26	145.73	0.44
31.12.1999	127.39	24.87	347.53	281.61	6.43	132.88	26.64	366.26	294.39	6.90
31.12.2000	124.36	17.76	169.76	257.13	8.32	127.93	19.27	177.14	265.21	9.10
31.12.2001	86.02	2.36	110.99	145.67	0.19	60.57	(-)	48.05	96.58	(-)
31.12.2002	119.83	12.22	227.92	322.38	2.56	109.43	9.75	199.97	292.14	2.01
31.12.2003	139.41	29.73	484.82	622.12	7.49	128.54	26.13	438.60	571.26	6.56
31.12.2004	125.08	44.17	518.67	474.00	4.39	122.31	42.48	504.01	462.89	4.22
31.12.2005	163.53	58.94	806.20	569.37	6.49	169.18	62.29	841.03	590.09	6.87
31.12.2006	260.85	132.95	1301.20	891.91	11.51	223.24	102.88	1070.92	756.92	8.83

Method	CAPM – annual WIG					CAPM – annual WIG20				
Date	BRE	KGHM	BPH	ING Bank Śląski	Millennium	BRE	KGHM	BPH	ING Bank Śląski	Millennium
31.12.2007	377.71	108.30	1069.51	867.96	9.76	354.53	95.03	981.40	810.98	8.50
31.12.2008	149.37	(-)	0.71	172.68	(-)	145.53	(-)	(-)	166.76	(-)
31.12.2009	316.41	63.53	64.13	710.54	6.71	285.89	54.09	56.59	638.71	5.69
31.12.2010	321.69	155.23	110.15	976.58	7.15	310.51	145.38	105.17	940.52	6.68
31.12.2011	214.53	53.98	40.99	608.02	1.32	203.60	40.53	37.47	573.46	0.91

(-) – Estimated balance sheet valuation based on the adopted method assumes negative values.
Source: author's research.

The last concept for fair value estimations is based on HEV. Fair value estimations are based on two exponential smoothing factors: inflation rates and risk-free returns. Assuming that smoothing coefficient α is dependent on inflation rates and risk-free rates of return, balance sheet valuations of shares are performed for the analysed period (Table 11).

Table 11. **Estimating share values of 250 Plus companies, HEV according to annual inflation and annual risk-free rate (PLN)**

Method	HEV – annual inflation					HEV – annual risk-free rate				
Date	BRE	KGHM	BPH	ING Bank Śląski	Millennium	BRE	KGHM	BPH	ING Bank Śląski	Millennium
31.12.1998	78.53	11.57	202.11	213.98	3.40	79.06	11.66	202.68	210.86	3.38
31.12.1999	92.84	14.95	206.57	199.67	4.87	93.75	15.20	206.42	201.51	5.05
31.12.2000	133.11	26.14	205.48	273.79	11.84	132.85	26.10	209.13	269.00	11.21
31.12.2001	130.10	24.91	234.65	240.84	6.43	127.74	22.59	233.75	256.06	5.71
31.12.2002	117.52	13.01	230.66	320.02	2.76	113.54	13.07	236.17	328.51	2.83
31.12.2003	88.15	13.92	274.29	381.73	3.27	88.44	14.76	279.75	379.24	3.23
31.12.2004	94.31	26.63	368.07	348.71	2.62	95.12	26.82	373.89	350.36	2.65
31.12.2005	114.76	31.73	513.34	391.43	3.39	119.07	34.18	532.16	405.13	3.53
31.12.2006	173.61	63.23	755.36	569.63	5.32	182.15	64.59	764.36	580.07	5.46
31.12.2007	349.00	90.29	863.23	764.69	8.23	350.34	90.43	856.72	764.35	8.26
31.12.2008	485.29	100.84	99.60	706.15	11.07	470.74	97.17	96.36	692.23	10.66
31.12.2009	200.79	33.39	38.50	453.67	3.01	202.72	35.75	39.98	464.28	3.07
31.12.2010	262.65	110.03	83.22	786.86	4.81	263.52	111.36	82.96	789.13	4.81
31.12.2011	298.90	167.51	67.54	822.28	4.80	299.05	167.67	67.64	824.37	4.81

Source: author's calculations.

An assessment of economic and financial models applied in estimating balance sheet share valuations based on statistical methods

The results of the study provide many valuable insights into the application of economic and financial models in estimating balance sheet values of shares issued by 250+ and 5+ companies in the context of the comparability and reliability of financial statements. Assessments are based on DCF, HEV and CAPM models. The estimated balance sheet share valuations are referred to the actual fair value in active markets, which facilitates assessment based on statistical methods with the use of two statistical measures: maximum error and mean error.

The first assessment method is based on comparing the mean errors of balance sheet valuations performed with the use of the employed models. The assessments of estimated balance sheet valuations for 250+ and 5+ companies are presented in Tables 12 and 14.

The second method is based on the maximum error – the recorded value between share value estimations for 250+ and 5+ companies and the actual fair value. Assessments based on the maximum value in the analysed period are presented in Tables 13 and 15.

The assessment of estimating balance sheet valuations of shares on the basis of the maximum and mean error is based on the assumption that the best method is the one for which the maximum and mean errors have the lowest values.

The empirical results presented in Tables 12-15 lead to the conclusion that DCF based on WIG20 and an average monthly increase in WIG20 is characterised by the smallest maximum error for 250+ companies (837.1%). In the case of 5+ companies, the smallest maximum error is recorded for HEV based on risk-free returns (596.0%). On the other hand, CAPM based on annual WIG20 results in values closest to the actual fair value determined by active markets for 250+ and 5+ companies (250+ – 25.2%, 5+ – 51.0%, respectively).

The empirical research indicates that the results closest to fair value are obtained with the use of CAPM and DCF for 250+ and 5+ companies based on WIG20 annual returns. On the other hand, HEV based on annual risk-free returns and the maximum error leads to the best results for 5+companies.

Further research of a larger number of companies in longer periods of time is likely to verify the assessment of models for estimating balance sheet valuations of shares and to test the applicability of particular models.

Table 12. **Assessment of models for estimating balance sheet share values – 250 Plus companies, based on the mean error (%)**

Model	BRE	KGHM	BPH	ING Bank Śląski	Millennium	Mean error (all companies)
DCF – annual WIG return	0.57	2.69	71.11	58.13	17.04	29.91
DCF – annual WIG20 return	3.17	6.26	64.64	53.54	12.42	28.01
DCF – average monthly increase in annual WIG	0.50	2.76	71.03	58.04	16.96	29.86
DCF – average monthly increase in WIG20	3.07	6.16	64.75	53.68	12.54	28.04
DCF – annual risk-free rate	8.03	15.33	77.57	79.08	35.12	43.03
DCF – annual inflation	4.34	11.15	73.93	75.92	29.87	39.04
CAPM – annual WIG return	1.97	13.83	65.63	48.90	6.67	27.40
CAPM – annual WIG20 return	7.93	15.89	59.39	39.95	2.94	25.22
HEV – annual inflation	0.52	6.39	61.67	62.15	22.88	30.72
HEV – annual risk-free return	0.14	5.22	61.37	62.75	19.89	29.87

Source: author's calculations.

Table 13. **Assessment of models for balance sheet share valuations for 250 Plus companies based on maximum error (%)**

Model	BRE	KGHM	BPH	ING Bank Śląski	Millennium	Maximum error (all companies)
DCF – annual WIG	38.37	84.10	883.41	800.43	97.59	883.41
DCF – annual WIG20	37.76	94.84	837.11	788.84	109.12	837.11
DCF – average monthly increase in WIG	38.37	84.10	883.41	800.43	97.59	883.41
DCF – average monthly increase in WIG20	37.76	94.84	837.11	788.84	109.12	837.11
DCF – annual risk-free return	172.11	298.37	830.33	1088.13	327.56	1088.13
DCF – annual inflation	165.48	288.66	826.50	1089.73	317.15	1089.73
CAPM – annual WIG	50.71	81.88	928.38	673.56	193.84	928.38
CAPM – annual WIG20	48.67	83.27	843.65	629.59	157.25	843.65
HEV – annual inflation	146.97	258.59	730.03	946.16	284.41	946.16
HEV – annual risk-free rate	139.56	245.56	723.77	948.82	270.07	948.82

Source: author's calculations.

Table 14. **Assessment of models for balance sheet share valuations for 5 Plus companies based on mean error (%)**

Model	Vistula	Mostostal Zabrze	Mostostal export	Bytom	Próchnik	Mean error (all companies)
DCF – annual WIG	84.91	59.28	33.41	78.04	65.63	64.25
DCF – annual WIG20	78.84	52.76	27.60	69.20	57.92	57.26
DCF – average monthly increase in annual WIG	84.84	59.16	33.26	77.76	65.50	64.10
DCF – average monthly increase in annual WIG20	78.94	52.93	27.81	69.60	58.10	57.48
DCF – annual risk-free return	107.86	68.63	41.67	99.12	76.62	78.78
DCF – annual inflation	102.15	62.00	36.47	91.84	69.43	72.38
CAPM – annual WIG	105.49	59.13	29.57	64.35	61.04	63.92
CAPM – annual WIG20	78.33	49.33	19.77	57.65	49.91	51.00
HEV – annual inflation	87.92	53.44	28.78	75.55	56.00	60.34
HEV – annual risk-free return	83.97	47.77	25.80	69.18	49.70	55.28

Source: author's calculations.

Table 15. **Assessment of models for balance sheet share valuations for 5 Plus companies based on maximum error (%)**

Model	Vistula	Mostostal Zabrze	Mostostal export	Bytom	Próchnik	Maximum error (all companies)
DCF – annual WIG	729.29	462.11	103.03	499.42	211.60	729.29
DCF – annual WIG20	690.25	429.97	91.42	471.20	217.72	690.25
DCF – average monthly increase in annual WIG	729.29	462.11	103.03	499.42	211.60	729.29
DCF – average monthly increase in annual WIG20	690.25	429.97	91.42	471.20	217.72	690.25
DCF – annual risk-free return	684.53	488.46	137.95	467.07	337.44	684.53
DCF – annual inflation	681.30	449.07	132.15	464.73	296.38	681.30
CAPM – annual WIG	913.60	426.46	98.61	590.49	315.66	913.60
CAPM – annual WIG20	715.65	342.16	79.66	483.84	343.09	715.65
HEV – annual inflation	601.16	437.66	116.76	408.93	262.97	601.16
HEV – annual risk-free return	596.00	378.60	110.88	405.43	211.76	596.00

Source: author's calculations.

Closing remarks

The valuation of shares and other financial instruments poses a number of problems in theoretical and practical accounting. These problems result from the application of the fair value category in share valuation. This concept makes a distinction between two basic types of shares: those for which prices are determined in active markets and those for which such prices and markets do not exist. The former shares are valuated on the basis of accounting principles and categories. The valuation of the latter ones is based on valuation models and techniques.

The results presented in the paper indicate that if balance sheet valuations of shares cannot rely on fair value determined by active markets, valuation methods and techniques should make use of the CAPM and DCF models based on WIG20 returns and HEV based on risk-free returns.

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РЕЗЮМЕ

Белявський Павел

Порівняльний аналіз балансової вартості акцій компаній, які перебувають в лістингу 250 Plus та 5 Plus, за справедливою вартістю на активному ринку та вартістю на основі економічних і фінансових моделей

Фінансові інструменти є проблемним питанням в економічних науках, особливо в галузі бухгалтерського обліку, який має справу з безперервними вимірами цих інструментів на практиці. Однією з основних проблем є використання справедливої вартості для оцінки фінансових інструментів. Відповідно до цієї категорії, можуть бути ідентифіковані два основні фінансові інструменти - інструменти, ціни на які визначаються активних ринках, та інструменти, для яких таких ринків не існує. Перший клас інструментів оцінюється на основі облікових категорій, у той час як другий тип інструментів оцінюється на основі оціночних моделей і методів. У статті представлено моделі балансової оцінки акцій, які базуються на справедливій вартості. У статті також подано результати емпіричних досліджень на основі статистичних методів та зроблена спроба визначити економічні та фінансові моделі, за якими здійснюється оцінка компаній 250 Plus і 5 Plus максимально наближено до фактичної справедливої вартості в польській економічній реальності.

РЕЗЮМЕ

Белявский Павел

Сравнительный анализ балансовой стоимости акций компаний, находящихся в листинге 250 plus и 5 plus, по справедливой стоимости на активном рынке и стоимости на основе экономических и финансовых моделей

Финансовые инструменты являются проблемным вопросом в экономических науках, особенно в области бухгалтерского учета, который имеет дело с непрерывными измерениями этих инструментов на практике. Одной из основных проблем является использование справедливой стоимости для оценки финансовых инструментов. Согласно этой категории, могут быть идентифицированы два основных финансовые инструменты - инструменты, цены на которые определяются активных рынках, и инструменты, для каких рынков не существует. Первый класс инструментов оценивается на основе учетных категорий, в то время как второй тип инструментов оценивается на основе оценочных моделей и методов. В статье представлены модели балансовой оценки акций, основанные на справедливой стоимости. В статье также представлены результаты эмпирических исследований на основе статистических методов и сделана попытка определить экономические и финансовые модели, по которым осуществляется оценка компаний 250 Plus и 5 Plus максимально приближено к фактической справедливой стоимости в польской экономической реальности.

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