

A COMPARISON BASED ON STATISTICAL METHODS OF BALANCE SHEET VALUATIONS OF LISTED SHARES IN BULL AND BEAR MARKETS

В статті представлено моделі балансової оцінки акцій, що нотуються на фондових біржах, на основі вартості, що походить з активного ринку, та вартості, встановленої на підставі фінансово-економічних моделей. Ціллю статті є представлення результатів емпіричних досліджень, які на підставі статистичних методів порівнюють оцінку акцій за реальною вартістю з вартістю акцій, встановленою на підставі фінансово-економічних методів за два періоди. Перший період це цикл стабільного зросту цін на акції, який охоплює 1998-2007 роки. Другий період це цикл падіння цін на акції, який пов'язаний з глобальною фінансовою кризою і охоплює період в 14 років (1998-2011).

Ключові слова: фінансові інструменти, вартість, модель балансової оцінки, оцінка, фінансово-економічні моделі.

INTRODUCTION

The major objective of the paper is to present the problems of the valuation of financial instruments in accounting. Most controversial issues relate to the category of fair value. This category makes a distinction between two basic types of financial instruments: those with prices determined by active markets and those for which such prices and markets do not exist.

Because of a large number of primary and derivative instruments traded on the market, the paper focuses on the valuation of shares. The principles for balance sheet valuation based on fair value in active markets and estimations based on economic and financial models are identical for most financial instruments except those which are valued on the basis of amortized costs [2, 6].

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 Plus companies (with capitalization exceeding EUR 250m) and 50 Plus (with capitalization ranging from EUR 50m to EUR 250m) 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 [12]. It implies that primary and derivative financial instruments are valued 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 [5, 8, 15, 17, 18]. 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.

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 facilitate 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 [3-5].

Balance sheet valuations in the paper are based on the shares of medium (50 Plus) and large (250 Plus) listed companies, and they are classified, according to financial standards, 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 for medium and large companies at fair value in active markets at year-end are presented in Table 1.

Table 1. Balance sheet valuations – 50 Plus and 250 Plus companies at fair value at year-end, active market prices (PLN)

Date	Grajewo	Rafako	Kruszwica	Sanok	Dębica	Bank Handlowy	Żywiec	Kęty	Stalprodukt	Świecie
31.12.1998	4.18	6.90	7.20	24.10	52.00	43.80	420.00	33.10	10.20	8.60
31.12.1999	4.00	6.55	9.00	32.10	43.50	61.40	365.00	55.20	8.50	16.20
31.12.2000	5.70	6.85	8.30	33.00	34.00	61.50	208.00	44.00	14.60	22.00
31.12.2001	7.10	6.40	5.95	26.50	31.90	64.00	230.00	46.20	10.65	28.80
31.12.2002	6.90	4.37	5.20	29.50	48.00	74.50	390.00	50.80	13.00	36.90
31.12.2003	20.80	6.60	29.30	106.00	128.00	57.70	434.00	135.00	26.00	77.20
31.12.2004	25.00	13.00	35.00	141.00	98.50	64.10	452.00	131.00	78.50	58.00
31.12.2005	35.50	19.85	26.10	133.00	65.00	66.50	484.50	125.50	78.00	51.00
31.12.2006	56.00	39.25	75.40	205.00	77.40	86.80	490.00	200.00	540.00	104.00
31.12.2007	53.00	11.12	42.05	185.00	105.20	99.90	640.00	160.00	750.00	67.90
31.12.2008	6.78	2.90	44.27	5.25	37.90	48.00	468.40	60.00	295.10	39.70
31.12.2009	16.35	10.00	59.75	10.30	66.40	70.00	480.00	121.10	594.00	76.25
31.12.2010	10.60	13.40	67.95	14.00	65.30	93.50	566.00	127.10	276.10	77.50
31.12.2011	5.71	7.77	51.85	12.00	53.95	67.90	515.00	104.50	230.00	58.05

Source: author's calculations.

Estimation of balance sheet values – shares of 50 Plus companies based on economic and financial models

The estimation of values of shares issued by 50 Plus companies is based on 3 economic and financial models: DCF [9, 11], HEV [7, 14], and CAPM [10, 13, 16].

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 representing the 50 Plus segment: Grajewo, Rafako, Kruszwica, Sanok and Dębica. 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 4 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. The results of estimated balance sheet valuations based on DCF are presented in Tables 2-3.

Table 2. Estimated share values - 50 Plus companies, based on DCF according to WIG annual returns and WIG20 annual returns (PLN)

Method	DCF - WIG annual returns					DCF - WIG20 annual returns				
	Date	Grajewo	Rafako	Kruszwica	Sanok	Dębica	Grajewo	Rafako	Kruszwica	Sanok
31.12.1998	17.53	8.68	10.78	46.45	75.36	16.54	8.19	10.17	43.84	71.13
31.12.1999	5.91	9.75	10.18	34.06	73.49	6.02	9.94	10.38	34.73	74.93
31.12.2000	3.95	6.46	8.88	31.68	42.93	4.06	6.65	9.14	32.60	44.17
31.12.2001	4.45	5.34	6.47	25.74	26.52	3.79	4.56	5.52	21.96	22.62
31.12.2002	7.33	6.60	6.14	27.35	32.92	6.91	6.23	5.79	25.78	31.04
31.12.2003	10.00	6.33	7.54	42.75	69.56	9.24	5.85	6.96	39.50	64.27
31.12.2004	26.61	8.44	37.49	135.61	163.76	25.91	8.22	36.50	132.03	159.43

31.12.2005	33.41	17.38	46.78	188.45	131.65	33.85	17.60	47.40	190.94	133.39
31.12.2006	50.27	28.11	36.96	188.33	92.04	43.93	24.56	32.30	164.59	80.44
31.12.2007	61.82	43.33	83.23	226.30	85.44	58.91	41.29	79.31	215.64	81.42
31.12.2008	25.93	5.44	20.57	90.52	51.47	27.45	5.76	21.78	95.80	54.48
31.12.2009	9.96	4.26	65.01	7.71	55.66	9.05	3.87	59.09	7.01	50.58
31.12.2010	19.42	11.88	70.96	12.23	78.86	18.78	11.49	68.64	11.83	76.28
31.12.2011	8.39	10.61	53.79	11.08	51.69	8.28	10.47	53.10	10.94	51.03

Source: author's calculations.

Table 3. Estimated share values - 50 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 WIG annual returns					DCF - average monthly increase in WIG20 annual returns				
	Date	Grajewo	Rafako	Kruszwica	Sanok	Dębica	Grajewo	Rafako	Kruszwica	Sanok
31.12.1998	17.30	8.56	10.64	45.85	74.40	16.86	8.35	10.37	44.68	72.51
31.12.1999	5.91	9.75	10.18	34.06	73.49	6.02	9.94	10.38	34.73	74.93
31.12.2000	3.95	6.46	8.88	31.68	42.93	4.06	6.65	9.14	32.60	44.17
31.12.2001	4.45	5.34	6.47	25.74	26.52	3.79	4.56	5.52	21.96	22.62
31.12.2002	7.33	6.60	6.14	27.35	32.92	6.91	6.23	5.79	25.78	31.04
31.12.2003	10.00	6.33	7.54	42.75	69.56	9.24	5.85	6.96	39.50	64.27
31.12.2004	26.61	8.44	37.49	135.61	163.76	25.91	8.22	36.50	132.03	159.43
31.12.2005	33.41	17.38	46.78	188.45	131.65	33.85	17.60	47.40	190.94	133.39
31.12.2006	50.27	28.11	36.96	188.33	92.04	43.93	24.56	32.30	164.59	80.44
31.12.2007	61.82	43.33	83.23	226.30	85.44	58.91	41.29	79.31	215.64	81.42
31.12.2008	25.93	5.44	20.57	90.52	51.47	27.45	5.76	21.78	95.80	54.48
31.12.2009	9.96	4.26	65.01	7.71	55.66	9.05	3.87	59.09	7.01	50.58
31.12.2010	19.42	11.88	70.96	12.23	78.86	18.78	11.49	68.64	11.83	76.28
31.12.2011	8.39	10.61	53.79	11.08	51.69	8.28	10.47	53.10	10.94	51.03

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.

Table 4. Estimated share values for 50 Plus companies based on CAPM for WIG and WIG20 annual returns (PLN)

Method	CAPM – WIG annual returns					CAPM - WIG20 annual returns				
	Date	Grajewo	Rafako	Kruszwica	Sanok	Dębica	Grajewo	Rafako	Kruszwica	Sanok
31.12.1998	9.17	4.06	-	22.52	54.15	5.58	2.16	-	12.56	42.64
31.12.1999	7.95	13.51	17.75	46.76	88.46	8.48	14.45	19.31	49.97	93.40
31.12.2000	2.90	4.55	3.81	22.61	36.21	3.11	4.92	4.61	24.36	37.91
31.12.2001	1.12	0.88	-	4.96	14.82	-	-	-	-	5.23
31.12.2002	6.78	6.05	5.14	25.12	31.46	5.56	4.87	3.40	20.36	27.37
31.12.2003	14.40	9.44	14.68	63.06	87.62	12.74	8.32	12.54	55.63	79.01
31.12.2004	33.77	10.98	59.22	175.02	189.76	32.56	10.57	56.30	168.54	184.19
31.12.2005	44.98	24.09	81.68	258.92	158.54	47.39	25.43	87.44	273.17	165.63
31.12.2006	71.64	41.45	70.81	274.80	115.13	56.28	32.24	51.48	214.41	94.11
31.12.2007	67.17	47.52	98.77	247.47	89.81	59.66	41.88	81.46	218.62	82.05

31.12.2008	-	-	-	-	-	-	-	-	-	-
31.12.2009	14.50	6.43	128.87	11.51	70.63	12.45	5.49	105.98	9.84	62.07
31.12.2010	23.25	14.49	101.13	14.84	88.04	21.88	13.60	92.58	13.94	83.89
31.12.2011	4.09	4.53	-	4.94	36.05	3.35	3.53	-	3.92	32.64

(-) - Estimated balance sheet valuation based on the adopted method assumes negative values.

Source: author's calculations.

The last method for estimating the fair value of listed shares issued by 50 Plus companies is based on the HEV model which considers 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 (Table 5).

Table 5. Estimating share values, 50 Plus companies, based on HEV for annual inflation rates and annual risk-free returns (PLN)

Method Data	HEV – annual inflation rates					HEV – annual risk-free returns				
	Grajewo	Rafako	Kruszwica	Sanok	Dębica	Grajewo	Rafako	Kruszwica	Sanok	Dębica
31.12.1998	17.49	9.42	11.49	48.42	80.62	16.19	9.18	11.07	46.05	77.82
31.12.1999	4.15	6.84	7.52	25.53	50.48	4.14	6.83	7.55	25.68	50.32
31.12.2000	4.27	6.60	8.89	32.24	42.01	4.44	6.63	8.82	32.33	41.02
31.12.2001	5.80	6.82	8.14	32.55	33.85	6.05	6.74	7.71	31.37	33.47
31.12.2002	7.10	6.37	5.94	26.55	32.16	7.07	6.10	5.84	26.95	34.29
31.12.2003	7.36	4.44	6.01	32.06	50.67	8.27	4.59	7.58	37.06	55.91
31.12.2004	21.15	7.14	29.78	108.95	125.51	21.31	7.38	29.99	110.27	124.40
31.12.2005	25.15	13.10	34.88	140.89	98.03	25.97	13.63	34.18	140.26	95.41
31.12.2006	36.07	20.39	27.46	134.99	65.34	37.11	21.38	29.98	138.67	65.98
31.12.2007	55.77	37.09	72.83	203.46	79.54	55.75	36.86	72.57	203.30	79.76
31.12.2008	50.05	10.59	42.19	173.52	100.90	47.87	10.21	42.30	165.04	97.73
31.12.2009	7.43	3.38	45.32	5.59	39.83	7.72	3.60	45.79	5.74	40.69
31.12.2010	16.00	10.20	60.24	10.52	66.33	15.89	10.27	60.41	10.60	66.31
31.12.2011	10.17	12.90	66.53	13.82	64.30	10.18	12.92	66.58	13.83	64.33

Source: author's calculations.

Estimating balance sheet share values, 250 Plus companies, based on economic and financial models

The estimations of the share values of large listed companies (250 Plus) 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: Bank Handlowy, Żywiec, Kęty, Stalprodukt and Świecie. 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 4 variants. Cash flows are discounted in the following order: WIG annual returns, WIG20 annual returns, monthly average increase in WIG returns and monthly average increase in WIG20 returns. The results are presented in Tables 6-7.

Table 6. Estimating share values for 250 Plus companies based on DCF, WIG annual returns and WIG20 annual returns (PLN)

Method Date	DCF – WIG annual returns					DCF - WIG20 annual returns				
	Bank Handlowy	Żywiec	Kęty	Stalprodukt	Świecie	Bank Handlowy	Żywiec	Kęty	Stalprodukt	Świecie
31.12.1998	44.25	303.21	42.94	20.16	15.77	41.77	286.19	40.53	19.02	14.89
31.12.1999	61.90	593.57	46.78	14.42	12.15	63.12	605.23	47.70	14.70	12.39

31.12.2000	60.60	360.24	54.48	8.39	15.99	62.35	370.63	56.05	8.63	16.45
31.12.2001	47.97	162.25	34.32	11.39	17.16	40.92	138.39	29.27	9.71	14.64
31.12.2002	66.04	237.34	47.68	10.99	29.72	62.27	223.78	44.95	10.36	28.02
31.12.2003	107.96	565.19	73.62	18.84	53.48	99.75	522.16	68.02	17.41	49.40
31.12.2004	73.82	555.24	172.71	33.26	98.77	71.87	540.58	168.15	32.38	96.16
31.12.2005	85.67	604.12	175.09	104.92	77.52	86.80	612.09	177.40	106.30	78.54
31.12.2006	94.17	686.07	177.71	110.45	72.22	82.29	599.57	155.31	96.52	63.11
31.12.2007	95.82	540.90	220.78	596.09	114.80	91.31	515.44	210.38	568.03	109.40
31.12.2008	48.88	313.15	78.29	366.97	33.22	51.73	331.43	82.86	388.39	35.16
31.12.2009	70.49	687.86	88.11	433.36	58.30	64.06	625.16	80.08	393.86	52.99
31.12.2010	83.14	570.08	143.83	705.47	90.56	80.42	551.43	139.12	682.39	87.60
31.12.2011	74.02	448.07	100.62	218.57	61.35	73.07	442.31	99.32	215.76	60.56

Source: author's calculations.

Table 7. Estimating share values for 250 Plus companies based on DCF, monthly average increase in WIG annual returns and monthly average increase in WIG20 annual returns (PLN)

Method	DCF – average monthly increase in WIG annual returns					DCF - average monthly increase in WIG20 annual returns				
	Bank Handlowy	Żywiec	Kęty	Stalprodukt	Świecie	Bank Handlowy	Żywiec	Kęty	Stalprodukt	Świecie
31.12.1998	43.69	299.32	42.39	19.90	15.57	42.58	291.71	41.31	19.39	15.18
31.12.1999	61.90	593.57	46.78	14.42	12.15	63.12	605.23	47.70	14.70	12.39
31.12.2000	60.60	360.24	54.48	8.39	15.99	62.35	370.63	56.05	8.63	16.45
31.12.2001	47.97	162.25	34.32	11.39	17.16	40.92	138.39	29.27	9.71	14.64
31.12.2002	66.04	237.34	47.68	10.99	29.72	62.27	223.78	44.95	10.36	28.02
31.12.2003	107.96	565.19	73.62	18.84	53.48	99.75	522.16	68.02	17.41	49.40
31.12.2004	73.82	555.24	172.71	33.26	98.77	71.87	540.58	168.15	32.38	96.16
31.12.2005	85.67	604.12	175.09	104.92	77.52	86.80	612.09	177.40	106.30	78.54
31.12.2006	94.17	686.07	177.71	110.45	72.22	82.29	599.57	155.31	96.52	63.11
31.12.2007	95.82	540.90	220.78	596.09	114.80	91.31	515.44	210.38	568.03	109.40
31.12.2008	48.88	313.15	78.29	366.97	33.22	51.73	331.43	82.86	388.39	35.16
31.12.2009	70.49	687.86	88.11	433.36	58.30	64.06	625.16	80.08	393.86	52.99
31.12.2010	83.14	570.08	143.83	705.47	90.56	80.42	551.43	139.12	682.39	87.60
31.12.2011	74.02	448.07	100.62	218.57	61.35	73.07	442.31	99.32	215.76	60.56

Source: author's calculations.

The second method for fair value estimations is based on CAPM. The model is used in two variants. The first one assumes that the market 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 8. Estimating share values for 250 Plus companies based on CAPM, WIG annual returns and WIG20 annual returns (PLN)

Method	CAPM – WIG annual returns					CAPM - WIG20 annual returns				
	Bank Handlowy	Żywiec	Kęty	Stalprodukt	Świecie	Bank Handlowy	Żywiec	Kęty	Stalprodukt	Świecie
31.12.1998	45.31	314.03	30.17	-	11.57	42.11	293.09	23.43	-	9.22
31.12.1999	60.83	578.24	56.85	28.69	14.50	62.80	596.25	60.08	31.47	15.29
31.12.2000	61.40	367.38	45.47	2.01	13.62	62.53	373.80	47.68	2.96	14.23
31.12.2001	49.77	171.33	18.32	-	9.99	41.56	144.79	5.56	-	3.94
31.12.2002	66.29	238.68	45.44	8.62	28.47	62.42	225.37	39.36	4.69	24.88
31.12.2003	105.59	546.58	93.82	42.61	66.62	99.28	514.95	84.45	35.89	60.17
31.12.2004	72.83	544.06	201.69	58.93	113.62	71.64	535.52	195.65	55.67	110.34
31.12.2005	84.19	588.47	212.89	209.08	92.52	86.37	603.17	222.58	225.34	96.58

31.12.2006	92.17	664.24	224.83	24510	89.37	82.01	593.43	183.11	172.51	73.30
31.12.2007	95.40	537.39	232.70	744.19	120.36	91.29	515.20	212.10	588.41	110.20
31.12.2008	53.45	356.93	-	-	-	52.92	353.74	-	-	-
31.12.2009	68.88	664.39	113.16	999.84	73.15	63.77	616.62	99.24	808.15	64.42
31.12.2010	82.32	561.66	161.52	1104.57	100.54	80.25	548.11	153.75	997.79	95.90
31.12.2011	75.92	465.27	68.44	-	43.77	73.61	451.91	61.61	-	39.83

(-) - Estimated balance sheet valuation based on the adopted method assumes negative values.

Source: author's calculations.

The third 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 9).

Table 9. Estimating share values for 250 Plus companies based on HEV according to inflation rates and risk-free rates of return (PLN).

Method Date	HEV – annual inflation rates					HEV – annual risk-free returns				
	Bank Handlowy	Żywiec	Kęty	Stalprodukt	Świecie	Bank Handlowy	Żywiec	Kęty	Stalprodukt	Świecie
31.12.1998	49.44	357.72	46.48	20.97	16.51	48.89	363.80	45.18	19.92	15.74
31.12.1999	46.94	410.18	37.04	9.90	9.96	47.27	409.16	37.46	9.86	10.10
31.12.2000	61.42	340.40	53.45	9.46	17.11	61.43	324.04	52.28	10.09	17.71
31.12.2001	61.67	209.53	44.15	14.33	22.47	62.13	213.51	44.55	13.61	23.70
31.12.2002	64.17	232.54	46.27	10.69	28.93	65.56	253.79	46.88	11.00	30.00
31.12.2003	73.94	391.47	53.61	13.43	38.25	72.84	394.35	59.12	14.29	40.88
31.12.2004	58.24	435.52	134.66	30.43	75.58	58.48	436.19	134.51	32.40	74.86
31.12.2005	64.13	452.45	130.92	78.49	57.90	64.32	454.99	130.49	78.45	57.35
31.12.2006	67.06	484.65	127.56	90.76	52.46	68.10	484.93	131.37	114.39	55.17
31.12.2007	87.81	501.54	196.92	556.15	101.22	87.91	502.73	196.61	557.82	100.94
31.12.2008	96.58	629.04	153.61	720.94	66.10	94.14	620.94	148.89	699.47	64.77
31.12.2009	49.49	469.18	64.13	315.32	42.17	50.16	469.54	65.99	324.38	43.28
31.12.2010	71.41	485.17	121.46	574.88	76.33	71.88	486.89	121.58	568.55	76.35
31.12.2011	91.25	561.51	125.11	272.05	75.79	91.31	561.65	125.17	272.16	75.84

Source: author's calculations.

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

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 large and medium companies in two periods in the context of comparability and reliability of financial statements. Assessments are based on DCF, HEV and CAPM models. The estimated balance sheet share valuations in bull markets (1998-2007) and bear markets (1998-2011) 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 [1].

The first assessment method is based on comparing the mean errors of balance sheet valuations performed with the use of the employed economic and financial models. The assessments of estimated balance sheet valuations for 250 Plus and 50 Plus companies are presented in Tables 10-11 for bull markets and Tables 14-15 for bear markets.

The second method is based on the maximum error – the recorded value between share value estimations for 250 Plus and 50 Plus companies and the actual fair value. Assessments based on the maximum value in the analysed period are presented in Tables 12-13 for bull markets and Tables 16-17 for bear markets.

Table 10. Assessment of models for estimating balance sheet share valuations for 250 Plus companies based on mean error in 1998-2007 (%)

Model	Bank Handlowy	Żywiec	Kęty	Stalprodukt	Świecie	Mean error (all companies)
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DCF – WIG annual returns	9.95	14.17	5.92	3.46	10.13	8.73
DCF – WIG20 annual returns	4.88	9.88	1.73	7.24	5.67	5.88
DCF – average monthly increase in WIG annual returns	9.82	14.08	5.75	3.71	9.90	8.65
DCF – average monthly increase in WIG20 annual returns	5.06	10.01	1.97	6.88	6.01	5.99
CAPM – WIG annual returns	9.40	13.28	7.75	12.58	12.46	11.09
CAPM – WIG20 annual returns	4.84	9.68	0.92	35.83	3.78	11.01
HEV – annual inflation rates	4.77	3.09	5.06	11.44	1.94	5.26
HEV – annual risk-free returns	4.58	2.88	4.91	11.48	1.43	5.06

Source: author's research.

Table 11. Assessment of models for estimating balance sheet share valuations for 250 Plus companies based on mean error in 1998-2011 (%)

Model	Bank Handlowy	Żywiec	Kęty	Stalprodukt	Świecie	Mean error (all companies)
DCF – WIG annual returns	7.14	9.97	5.13	8.09	6.00	7.27
DCF – WIG20 annual returns	2.98	5.94	1.86	4.75	2.30	3.56
DCF – average monthly increase in WIG annual returns	7.05	9.90	5.01	7.91	5.83	7.14
DCF – average monthly increase in WIG20 annual returns	3.11	6.03	2.03	5.00	2.54	3.74
CAPM – WIG annual returns	7.40	9.79	4.14	38.86	1.57	12.35
CAPM – WIG20 annual returns	3.14	6.10	12.27	62.40	6.49	18.08
HEV – annual inflation rates	2.50	0.29	5.26	7.82	2.24	3.62
HEV – annual risk-free returns	2.38	0.24	4.93	7.22	2.48	3.45

Source: author's research.

Table 12. Assessment of models for estimating balance sheet share valuations for 250 Plus companies based on maximum error in 1998 – 2007 (%)

Model	Bank Handlowy	Żywiec	Kęty	Stalprodukt	Świecie	Maximum error (all companies)
DCF – WIG annual returns	87.11	73.19	45.47	97.60	83.42	97.60
DCF – WIG20 annual returns	72.87	78.19	49.62	86.51	73.12	86.51
DCF – average monthly increase in WIG annual returns	87.11	73.19	45.47	95.07	81.06	95.07
DCF – average monthly increase in WIG20 annual returns	72.87	78.19	49.62	90.11	76.46	90.11
CAPM – WIG annual returns	83.00	76.63	69.63	237.49	95.89	237.49
CAPM – WIG20 annual returns	72.05	79.71	87.97	333.64	90.24	333.64
HEV – annual inflation rates	28.14	63.65	60.29	105.62	91.99	105.62
HEV – annual risk-free returns	26.24	55.79	56.20	95.31	83.01	95.31

Source: author's research.

Table 13. Assessment of models for estimating balance sheet share valuations for 250 Plus companies based on maximum error in 1998 – 2011 (%)

Model	Bank Handlowy	Żywiec	Kęty	Stalprodukt	Świecie	Maximum error (all companies)
DCF – WIG annual returns	87.11	73.19	45.47	155.51	83.42	155.51
DCF – WIG20 annual returns	72.87	78.19	49.62	147.15	73.12	147.15
DCF – average monthly increase in WIG annual returns	87.11	73.19	45.47	155.51	81.06	155.51
DCF – average monthly increase in WIG20 annual returns	72.87	78.19	49.62	147.15	76.46	147.15
CAPM – WIG annual returns	83.00	76.63	121.54	641.89	103.68	641.89
CAPM – WIG20 annual returns	72.05	79.71	124.57	649.96	105.52	649.96
HEV – annual inflation rates	101.22	63.65	156.02	144.30	91.99	156.02
HEV – annual risk-free returns	96.12	55.79	148.16	137.03	83.01	148.16

Source: author's research.

Table 14. Assessment of models for estimating balance sheet share valuations for 50 Plus companies based on mean error in 1998–2007 (%)

Model	Grajewo	Rafako	Kruszwica	Sanok	Dębica	Mean error (all companies)
DCF – WIG annual returns	26.01	31.33	15.57	7.71	21.51	20.43
DCF – WIG20 annual returns	20.41	25.57	11.19	3.04	17.31	15.51
DCF – average monthly increase in WIG annual returns	25.47	31.17	15.38	7.46	21.33	20.16
DCF – average monthly increase in WIG20 annual returns	21.18	25.80	11.46	3.39	17.58	15.88
CAPM – WIG annual returns	16.86	36.56	13.24	5.76	26.52	19.79
CAPM – WIG20 annual returns	0.42	19.98	7.70	7.99	18.47	10.91
HEV – annual inflation returns	14.21	16.32	5.01	1.98	4.56	8.42
HEV – annual risk-free returns	12.63	15.99	4.07	2.51	4.02	7.84

Source: author's research.

Table 15. Assessment of models for estimating balance sheet share valuations for 50 Plus companies based on mean error in 1998–2011 (%)

Model	Grajewo	Rafako	Kruszwica	Sanok	Dębica	Mean error (all companies)
DCF – WIG annual returns	45.26	26.33	8.51	118.27	17.95	43.27
DCF – WIG20 annual returns	41.90	22.39	4.53	121.35	14.60	40.96
DCF – average monthly increase in WIG annual returns	44.87	26.22	8.37	118.10	17.82	43.08
DCF – average monthly increase in WIG20 annual returns	42.44	22.56	4.72	121.61	14.79	41.22
CAPM – WIG annual returns	13.14	0.53	3.90	131.32	11.37	32.05
CAPM – WIG20 annual returns	28.45	14.87	23.79	147.26	3.58	43.59
HEV – annual inflation rates	61.05	28.90	2.73	223.57	13.76	66.00
HEV – annual risk-free returns	57.70	27.91	2.16	211.80	12.87	62.49

Source: author's research.

Table 16. Assessment of models for estimating balance sheet share valuations for 50 Plus companies based on maximum error in 1998–2007 (%)

Model	Grajewo	Rafako	Kruszwica	Sanok	Dębica	Maximum error (all companies)
DCF – WIG annual returns	319.29	289.63	97.94	92.72	102.54	319.29
DCF – WIG20 annual returns	295.76	271.29	88.62	81.90	105.21	295.76
DCF – average monthly increase in WIG annual returns	313.91	289.63	97.94	90.25	102.54	313.91
DCF – average monthly increase in WIG20 annual returns	303.40	271.29	88.62	85.41	105.21	303.40
CAPM – WIG annual returns	119.31	327.32	212.93	94.67	143.91	327.32
CAPM – WIG20 annual returns	114.51	276.58	256.62	130.64	154.82	276.58
HEV – annual inflation rates	318.53	233.51	79.50	100.92	60.41	318.53
HEV – annual risk-free returns	287.44	231.51	74.12	91.07	56.32	287.44

Source: author's research.

Table 17. Assessment of models for estimating balance sheet share valuations for 50 Plus companies based on maximum error in 1998–2011 (%)

Model	Grajewo	Rafako	Kruszwica	Sanok	Dębica	Maximum error (all companies)
DCF – WIG annual returns	319.29	289.63	97.94	1624.19	102.54	1624.19
DCF – WIG20 annual returns	304.81	271.29	88.62	1724.82	105.21	1724.82
DCF – average monthly increase in WIG annual returns	313.91	289.63	97.94	1624.19	102.54	1624.19
DCF – average monthly increase in WIG20 annual returns	304.81	271.29	88.62	1724.82	105.21	1724.82
CAPM – WIG annual returns	432.14	327.32	240.62	1854.93	143.91	1854.93
CAPM – WIG20 annual returns	443.69	309.77	256.62	1909.52	154.82	1909.52
HEV – annual inflation rates	638.16	265.34	79.50	3205.06	166.23	3205.06
HEV – annual risk-free returns	605.99	251.97	74.12	3043.53	157.85	3043.53

Source: author's research.

The assessment of economic and financial models for 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 10-11 lead to the conclusion that HEV based on annual risk-free returns is characterised by the smallest mean error for 250 Plus companies in bull markets (5.06%) and in bear markets (3.45%). In the case of 50 Plus companies the smallest mean error is recorded for HEV based on risk-free returns in bull markets (7.84%) and CAPM based on WIG annual returns in bear markets (32.05%). The results are presented in Tables 14-15. On the other hand, DCF based on WIG20 annual returns has the smallest maximum error values for the 250 Plus segment in bull markets (86.51%) as well as in bear markets (147.15%). The measurement of the maximum error for 250 Plus companies is presented in Tables 12-13. In the case of 50 Plus companies the most reliable fair value is obtained with the use of CAPM based on WIG20 annual returns for bull markets (276.58%) as well as DCF based on WIG annual returns for bear markets (1624.19%).

The results of the analysis indicate that in the periods of a steady increase in share values the HEV model with filtration based on the annual risk-free rate of return leads to estimations which are closest to the actual fair value in the case of assessments based on the mean error for 50 Plus and 250 Plus companies. In bull markets the shares of 50 Plus companies react to the WIG index which represents the entire market of listed shares. The most reliable fair value estimations result from the use of CAPM based on WIG annual returns. Simultaneously, the shares of 250 Plus companies are less affected by bear markets – the most reliable value estimations result from the use of HEV based on annual risk-free returns. As regards the assessment of economic and financial models based on the maximum error, the most reliable fair value estimations result from the use of DCF based on WIG20 annual returns for the 250 Plus segment in bull and bear markets. It indicates a close correlation between the value of 250 Plus shares and the WIG20 index. In the case of the maximum error, the shares of the 50 Plus segment in bull markets are most closely linked to CAPM based on WIG20 annual returns, while the best results in bear markets are obtained with the use of DCF and annual returns for the entire market, i.e. the WIG index.

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 economic and financial models.

CLOSING REMARKS

The valuation of shares and other financial instruments poses a number of problems in economic sciences, especially in 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 valued 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 accounting principles and categories – especially with regard to fair value based on active market prices – valuation methods and techniques for bull markets should make use of HEV based on risk-free returns (the smallest mean error for 50 Plus and 250 Plus companies) as well as CAPM and DCF based on WIG and WIG20 annual returns for the shares of 50 Plus and 250 Plus companies (the smallest maximum error).

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