

APPENDIX 1. Rating attributes toolkit for residential property market

Group I – supply-side indicators:		det*.	des.	
a) social set	1 – ranking of quality of life for “quality of local government” (max 100 p.)	x		
	2 – number of deaths of those older than 50 (per 1000 residents)	x		
	3 – contribution of individuals in the post-productive age (per cent)	x		
b) economic and political set	4 – fuel prices per liter		x	
	5 – number of new registered businesses in industry and construction (per 10000 residents)	x		
	6 – local government spending on public utilities and environmental protection (per resident)	x		
	7 – local government spending on investments (per resident)	x		
c) residential set	8 – vacancy rate for office properties (per cent)		x	
	9 – vacancy rate for retail properties (per cent)		x	
	10 – vacancy rate for warehouses properties (per cent)		x	
	11 – number of apartments (per 1000 residents)	x		
	12 – usable dwelling space (per resident)	x		
	13 – average number of rooms in a dwelling	x		
	14 – value of new mortgage agreement (per resident)	x		
	15 – total number of issued construction permits (per 10000 residents)	x		
	16 – number of issued construction permits – individual (per 10000 residents)	x		
	17 – number of apartments with started constructions (per 10000 residents)	x		
	18 – number of completed apartments (per 10000 residents)	x		
	19 – number of completed rooms (per 10000 residents)	x		
	20 – the average number of rooms in completed apartments	x		
	21 – the average area of a room (per m ²)	x		
	22 – number of developers on the local market (per 10000 residents)	x		
	23 – number of property transactions (per 10000 residents)	x		
	24 – value of property transactions (per 1000 residents)	x		
	25 – affordability of rental housing (number of square meters that can be financed from an average local salary per month)			x
	26 – difference in the structure of (<=40) supply of usable area per transaction and offers on the primary market (per cent)			x
	27 – difference in the structure of (40; 60) supply of usable area per transaction and offers on the primary market (per cent)			x
	28 – difference in the structure of (60; 80) supply of usable area per transaction and offers on the primary market (per cent)			x
	29 – difference in the structure of (>80) supply of usable area per transaction and offers on the primary market (per cent)	x		
	30 – structure of (>80) supply of usable area per transaction on the primary market (per cent)			x
	31 – structure of (>80) usable area supply for offers/quotation on the primary market (per cent)	x		
	32 – balance of supply and demand for apartments below or equal to 50 m ² on the primary market (per cent)	x		
	33 – balance of supply and demand for apartments over to 50 m ² on the primary market (per cent)			x
	34 – difference in the structure of (<=40) supply of usable area per transaction and offers on the secondary market (per cent)			x
	35 – difference in the structure of (40; 60) supply of usable area per transaction and offers on the secondary market (per cent)			x
	36 – difference in the structure of (60; 80) supply of usable area per transaction and offers on the secondary market (per cent)			x
	37 – difference in the structure of (>80) supply of usable area per transaction and offers on the secondary market (per cent)	x		
	38 – structure of (>80) supply of usable area per transaction on the secondary market (per cent)			x
	39 – structure of (>80) supply of usable area per transaction per offers on the secondary market (per cent)	x		
	40 – local government spending on housing policy (per residents)	x		
41 – number of property offers – average from the most popular websites in Poland (per 1000 residents)	x			
d) spatial and location set	42 – per cent of land covered by zoning plans	x		
	43 – level of retail area (m ² /1000 residents)	x		
	44 – supply of office area (m ² /1000 residents)	x		
	45 – supply of warehouse area (m ² /1000 residents)	x		

(Continued)

Group II – demand-side indicators:		det*.	des.
(Continued)			
a) social set	46 – forecasting of population number for 2020 (per cent in comparison with 2013)	x	
	47 – forecasting of population number for 2035 (per cent in comparison with 2013)	x	
	48 – number of private cars (per 10 residents)	x	
	49 – ranking of quality of life for health (max 100 p.)	x	
	50 – ranking of quality of life for satisfaction with life (max 100 p.)	x	
	51 – ranking of quality of life for safety (max 100 p.)	x	
	52 – unemployment rate (per cent)		x
	53 – unemployment rate (per cent average from last 5 years)		x
	54 – difference between regional and local unemployment rate (per cent)	x	
	55 – population growth (per 1000 residents)	x	
	56 – net migration rate (per 1000 residents)	x	
	57 – number of marriages (per 1000 residents)	x	
	58 – number of students (per 1000 residents)	x	
	59 – contribution of individuals in the productive age (per cent)	x	
	60 – contribution of individuals in the pre-productive age group (per cent)	x	
	61 – contribution of individuals in the post-productive age (per cent)	x	
	62 – number of sports clubs (per 10000 residents)	x	
	63 – number of cultural centers (per 100000 residents)	x	
	64 – number of cinemas (per 100000 residents)	x	
	65 – number of hypermarkets (per 100000 residents)	x	
b) economic and political set	66 – average rent in a new shopping centre (affordability per average local salary - m ²)		x
	67 – average rent in the office blocks (affordability per average local salary – PLN/m ²)		x
	68 – number of science and technology parks	x	
	69 – fuel prices (per liter)		x
	70 – number of suspended business activities (per 1000 residents)		x
	71 – number of new businesses (per 1000 residents)	x	
	72 – number of self-employed individuals (per 1000 residents)	x	
	73 – number of businesses employing 0–9 workers (per 10000 individuals in the productive age)		x
	74 – number of businesses employing 10–49 workers (per 10000 individuals in the productive age)		x
	75 – number of businesses employing 50–249 workers (per 10000 individuals in the productive age)	x	
	76 – number of businesses employing 250 and more workers (per 10000 individuals in the productive age)	x	
	77 – number of businesses with foreign capital (per 10000 residents)	x	
	78 – Gross Domestic Product (Poland=100 p.)	x	
	79 – local government income (per resident)	x	
	80 – local government spending (per resident)	x	
	81 – difference between the national average salary and the average salary on the local market (per cent)	x	
c) residential set	82 – the average number of individuals in an apartment	x	
	83 – availability of apartments on the primary market in terms of average salary (m ²)	x	
	84 – availability of apartments on the secondary market in terms of average salary (m ²)	x	
	85 – offered purchasing power on the local housing market (average salary on the local market / average price per 1 m ² of property on the local market)	x	
	86 – transaction purchasing power on the local housing market (average salary on the local market / average price per 1 m ² of property on the local market)	x	
	87 – availability of mortgages in terms of m ² (average property price / average credit rating of a family or individual)	x	
	88 – availability of mortgages on the secondary market in terms of PLN credit (m ²)	x	
	89 – availability of mortgages on the primary market in terms of PLN credit (m ²)	x	
	90 – value of new mortgages (per resident)	x	
	91 – number of real estate agents on the local market (per 10000 residents)	x	
	92 – number of real estate appraisers on the local market (per 10000 residents)	x	
	93 – number of property transactions (per 10000 residents)	x	
	94 – value of property transactions (per 1000 residents)	x	
	95 – average time on the secondary market (in days)		x
	96 – difference between the average offered and transaction price of m ² the real estate on the primary market (PLN)		x
	97 – difference between the average offered and transaction price of m ² the real estate on the secondary market (PLN)		x
	98 – changes in local property offered prices (per cent)	x	
	99 – changes in local property transaction prices (per cent)	x	
	100 – difference between changes in offered and transaction prices on the secondary market (per cent)		x
	101 – difference between changes in offered and transaction prices on the primary market (per cent)	x	
	102 – affordability of rental housing on the secondary market (number of square meters that can be financed from an average local salary per month)		x

(Continued)

Group II – demand-side indicators:		det*.	des.	
(Continued)				
c) residential set	103 – difference between the minimum and maximum transaction prices on the primary market (PLN/m ²)	x		
	104 – balance of supply and demand for apartments below or equal to 50 m ² (per cent)		x	
	105 – balance of supply and demand for apartments of over to 50 m ² (per cent)		x	
	106 – difference between the minimum and maximum transaction prices on the secondary market (PLN/m ²)	x		
	107 – difference between offered and transaction prices for low standard (PLN/m ²)		x	
	108 – difference between offered and transaction prices for medium standard (PLN/m ²)		x	
	109 – difference between offered and transaction prices for high standard (PLN/m ²)		x	
	110 – difference between low and high standard for offered prices (PLN/m ²)	x		
	111 – difference between low and high standard for transaction prices (PLN/m ²)	x		
	112 – ratio of replacement value per 1 m ² of property to the transaction price (per cent)	x		
	113 – ratio of replacement value per 1 m ² of property to the offered price (per cent)	x		
	d) spatial and location set	114 – per cent of green areas (per cent)		x
		115 – cycle path (per 10000. residents)		x
116 – length of bus-lane (km)			x	
117 – roads with hard surface (km per 10000 residents)			x	
118 – roads with hard surface (km per km ² of city)			x	
119 – number of green parks in the region			x	
120 – population density (per km ²)			x	
121 – number of buses (per 1000 residents)			x	
122 – number of high schools (per 100000 residents)			x	

*det – determinants; des. – destimulants

Source: Own study.

APPENDIX 2. Sample of the cross-correlation time-series (3 years) for combination no. 3

Correlation	2013–2	2013–3	2012–2	2012–3	2011–2	2011–3
2013–2	1					
2013–3	0.94	1				
2012–2	0.98	0.96	1			
2012–3	0.93	0.99	0.96	1		
2011–2	0.96	0.91	0.97	0.91	1	
2011–3	0.92	0.98	0.95	1	0.91	1

Source: Own study.

APPENDIX 3. Synthetic variables determined based on factor analysis

No. of combination for synthetic variable	Synthetic variables for original features combination										
	comb. 1	comb. 3	comb. 4	comb. 5	comb. 6	comb. 8	comb. 9	comb. 11	comb. 12	comb. 13	comb. 14
Output synthetic variable	-0.005	0.201	0.009	-0.126	0.98	0.213	0.771	1.309	0.926	2.392	0.252
	-0.197	-1.255	-0.815	-0.632	-0.186	-0.022	-0.090	-1.251	0.314	0.964	0.663
	0.154	0.152	0.573	-0.232	-1.092	-0.464	0.299	-0.790	-0.759	-0.121	-0.214
	-1.546	0.353	-1.068	-0.509	-1.646	-0.132	-0.456	-0.907	-0.996	-0.858	0.697
	0.537	-1.478	-1.391	-0.733	-0.49	0.101	-0.908	-0.195	-0.081	-0.168	0.160
	-0.338	0.354	1.499	0.353	-0.346	0.659	-0.415	-0.189	-0.374	0.204	-0.320
	1.537	0.744	2.294	3.432	2.749	1.200	-0.107	0.537	0.595	1.502	-1.835
	-0.961	2.343	-0.777	-0.327	0.053	-0.471	-0.137	-0.933	-1.268	-1.020	1.625
	0.304	0.198	0.728	0.270	0.674	0.810	-0.494	1.488	2.075	0.999	-1.117
	-0.210	-0.513	-0.872	-0.510	0.204	0.319	-0.036	-0.503	0.608	-0.831	-0.687
	0.925	-0.106	0.453	0.227	-0.379	1.307	-0.56	2.102	1.13	-0.629	-1.378
	2.089	-1.682	-0.842	-0.437	0.191	0.320	0.163	0.686	0.848	-0.484	-0.762
	0.156	-0.461	-0.029	-0.400	-1.184	-0.72	-0.504	-0.422	0.137	-0.261	1.445
	-1.317	0.066	-0.196	-0.510	0.126	0.268	-0.767	-0.113	-0.798	-0.858	0.362
	-1.141	0.940	-0.219	0.260	0.272	-3.011	3.348	-0.465	-1.383	-0.312	1.067
0.012	0.140	0.654	-0.122	0.072	-0.377	-0.105	-0.350	-0.973	-0.519	0.041	
Test of fit goodness – R ² .	0.95	0.93	0.97	0.95	0.98	0.94	0.94	0.85	0.98	0.91	0.89

Source: Own study.