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SUPPLEMENTARY MATERIALS
Rating attributes toolkit for the residential property market
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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

	Synthetic variables for original features combination										
No. of combination for synthetic variable	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.