Part

Supplementary materials for the paper

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A Literature review – additional tables and materials

Table A1: Past estimates of the platform economy

Author / Institution	Data source	Coverage	the definition of platform work	Results
ETUI Internet and Platform Work Survey Piasna and Drahokoupil (2019)	Face-to-face survey	Bulgaria, Hungary, Latvia, Poland and Slovakia in 2018–2019; working age adults (aged 18–64); in total, 4,731 respondents	work using online platforms at least once a week. Online platforms are defined as websites or apps through which workers can find short jobs or tasks, such as IT work, data entry, delivery, driving, personal services, etc.	0.4% in Poland and Slovakia; 0.5% in Latvia; 0.8% in Bulgaria; 1.9% in Hungary
University of Hertfordshire, Foundation for European Progressive Studies, UNI Europa Huws et al. (2019)	large-scale online surveys	11 European countries in 2016–2019	platform work conducted at least once a week	4.7% in the UK, 6.2% in Germany and 9.5% in Austria (2016), 28.5% in the Czech Republic (2019)
A Collaborative Economy (COLLEEM) survey conducted by the Joint Research Centre of the European Commission Brancati et al. (2020)	large-scale online surveys	2017 and 2018 in 14 and 16 EU member states; 38,878 responses (internet users aged 16–74 years)	workers who have gained income from providing services via online platforms, where the match between provider and client is made digitally, payment is conducted digitally via the platform, and work is performed either (location-independent) web-based or on-location	4.1% of the adult population in Finland and 9.9% in the United Kingdom
ILO 2015 Berg (2016)	"1,167 responses of which 814 were from AMT and 353 were from Crowdflower"	2015, US and India	Amazon Mechanical Turk and Crowdflower platforms	Only characteristics of crowd workers
Drahokoupil and Piasna (2019)	administrative data provided by Smart and a survey of workers	Belgium 2016–2018	food delivery platforms, Deliveroo	3,828 member-riders in October 2017
Aleksynska et al. (2019)	"Internet survey; 1000 respondents of the age 18 and older"	Ukraine 2017	Workers of online platforms are	Only characteristics of online workers
Lee et al. (2018)	"self-reported online survey was conducted among Uber users, 295 respondents"	Hong Kong 2016	Uber users	analysis of users' intention of using Uber

B Sample surveys – details

B.1 The ICT survey

The question *Have you used any website or app to arrange transportation (e.g. by car) from another person in the last 12 months?* is only presented to respondents who reported using the Internet in the last year. Possible answers changed over time as shown below:

- 2017
  - yes, dedicated websites or applications (e.g. UBER, BlaBlaCar)
  - yes, other websites or applications (including social networking sites)
- 2018
  - yes, intermediary websites or applications dedicated specifically to organizing transport (e.g. BlaBlaCar, yanosiktls.pl, jedziemyrazem.pl)
  - yes, other websites or applications (including social networking sites)
- 2019
  - yes, websites or applications that specialize in organizing trips (e.g. BlaBlaCar, jedziemyrazem.pl)
  - yes, other websites or applications (including social networking sites)
- 2020
  - yes, those offered by a given company (e.g. public transport, plane, taxi, Uber, Bolt, carsharing, electric scooters),
  - yes, those offered by a private person (e.g. BlaBlaCar, jedziemyrazem.pl)
- 2021
  - yes, a service offered by the company (e.g. public transport, plane, taxi, Uber, Bolt, carsharing, electric scooters),
  - yes, a service offered by a private person (e.g. BlaBlaCar, jedziemyrazem.pl)

C Mobile apps and websites selected for the study

Table A2: Gig economy apps selected for the study

Apps	**Regional availability**	**Application process and who can apply**	**How the user specifies working hours**	**How the user is informed about the work**
Glover	In many countries all over the world. In Poland mainly in big cities.	Creating an online account, online training is required, it is necessary to have a vehicle (car, motorcycle, bicycle), a smartphone with internet access, legal age is required	The courier sets their own working hours (mainly during peak demand) declaring availability (time blocks).	15 minutes before the start of a time block, the courier is notified to log into the app in order to confirm their availability in the booked hours. The app notifies the courier when the order has been received .
Wolt courier	In 24 countries, mainly in Europe (Japan and Israel are the exception) and in 129 cities (as of 06/23/2021)	Creating an online account, it is necessary to have a vehicle (car, motorcycle, bicycle), a smartphone with internet access, minimum age: 16	The courier sets their own working hours. Working hours are flexible but mainly when restaurants are open.	After going online, the courier automatically receives orders for rides in their area. The app sends a delivery message.
Bolt courier	In many countries mainly in Europe, Africa and Asia. Mexico, Ecuador and Paraguay are exceptions.	Creating an online account, it is necessary to have a vehicle (car, motorcycle, bicycle), a smartphone with internet access, online training is required, minimum age: 18	The courier sets their own working hours. Working hours are flexible but mainly when restaurants are open.	After receiving a new order, the courier receives the restaurant's address and information about how to pick up the order. The app sends a notification.
Uber driver	All over the world. In Poland mainly in cities.	Valid identity card; valid driving license for at least 1 year; certificate of no criminal record; confirmation of medical and psychological examination; in Poland Uber partner drivers need to hold a taxi license	The driver sets their working hours.	After going online, the driver automatically receives orders for rides in their area on their phone app.
Bolt driver	Mainly in Europe in more than 150 cities. It is also available in some cities in Africa, Asia, South and North America.	An online account is required. The driver's account is activated within one working day, after all required documents have been verified. In Poland a driver should be at least 18 years old and have at least one year of driving experience. Medical examinations and psychological tests are also required.	Drivers work according to their own schedule. No minimum hours of work are required	After going online, the driver automatically receives orders for rides in their area on their phone app.

Table A3: Non-gig economy apps selected for the study

Apps	**Regional availability**	**Application process and who can apply**	**How the user specifies working hours**	**How the user is informed about the work**
FREE NOW for drivers	FREE NOW is one of Europe's leading ride-hailing apps, which connects more than 45 million passengers with drivers in more than 150 cities (as of 06/23/2021). In Poland, the area of operation covers 7 big cities: Warsaw, Krakow, Tricity, Poznań, Wrocław, Katowice and Łódź.	Drivers wishing to join FREE NOW must register and create an account directly through the app. The next step is a mandatory visit at the office to verify the data and present original documents (a taxi license, a driving license, car registration certificate, legalization of the taximeter, a certificate of psychological examination)	Drivers decide which days of the week and at what times they want to work. Drivers are not on duty, they can earn extra money in their spare time and combine it with working for their current corporation.	All orders are received by the driver directly via the app. The app sends notifications about new rides. Drivers can plan their day by taking orders in advance.
iTaxi Kierowca K3	iTaxi is a Polish technology platform, which provides travel-related services. iTaxi is available in more than 60 Polish cities.	Valid driving license; a taxi license is required to become an iTaxi driver (minimum age: 21). Drivers have to register as self-employed.	Drivers decide which days of the week and at what times they want to work. They have to be logged into the app throughout the entire period of their availability and execute orders provided by the operator.	After going online, the driver automatically receives orders for rides in their area. The app sends notification about the new ride.

C.1 Websites

For the study we identified the following websites:

- http://testuj.pl
- http://testarmy.com/
- http://www.utest.com/
- http://www.applause.com/
- http://whatusersdo.com/
- http://trymyui.com/
- http://www.testbirds.com/
- http://www.usertesting.com/
- https://crowdsourcedtesting.com/
- https://mycrowd.com/
- https://test.io/
- https://usabilityhub.com/
- https://globalapptesting.com/
- https://www.bugfinders.com/
- https://www.fiverr.com/
- https://www.upwork.com/
- https://www.freelancer.pl/
- https://www.toptal.com/
- https://www.guru.com/

- https://www.flexjobs.com/
- https://www.truelancer.com/
- https://www.clearvoice.com/
- https://www.mturk.com/
- https://www.clickworker.com/
- https://www.microworkers.com/
- https://www.useme.com/pl/

D Functional urban areas

At the time of joining the Urban Audit project, Statistics Poland did not have data on commuting. Consequently, for the purpose of 2003, 2006, 2009 and 2011 editions of the project, larger urban zones were defined as areas comprising one or more rings of LAU1 and LAU 2 units surrounding the city.

In 2012, for cities already included in the project a broader spatial coverage of functional urban areas was adopted (and for those introduced for the first time, FUAs were delimited by Eurostat), which was based on results of a survey of employment-related population flows in 2006. A functional urban area is an area in which at least 15% of the resident population commutes to work to the city center.

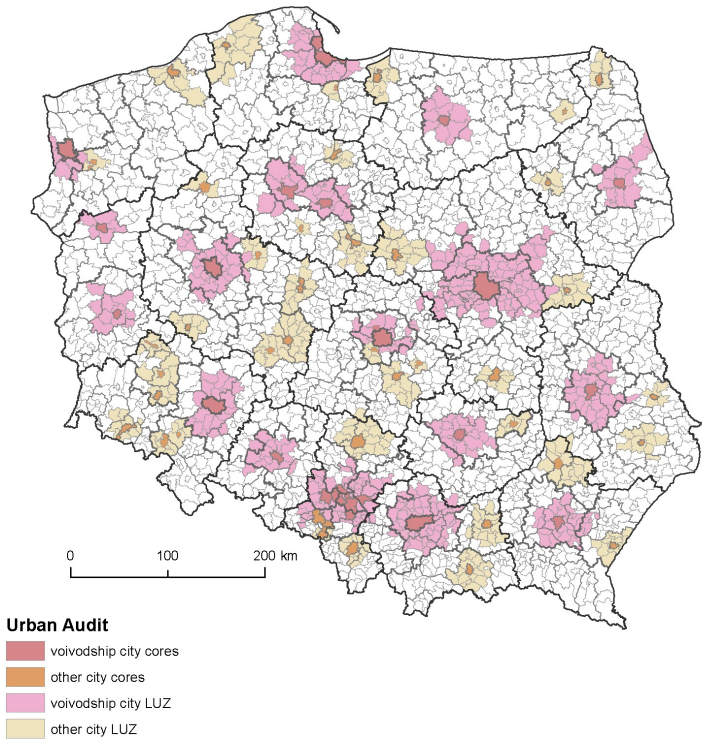

Figure 9: Functional urban areas (FUAs) in Poland in 2017

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In the project we focused on urban cores of provincial capital cities, their functional urban areas and the remaining parts of the provinces. A list of all spatial units is presented in Table A4.

Table A4: Spatial aggregation defined in the study based on functional urban areas

Province	**Functional area**	**City**
Dolnośląskie	Wrocław	Wrocław
Kujawsko-pomorskie	Bydgoszcz	Bydgoszcz
	Toruń	Toruń
Łódzkie	Łódź	Łódź
Lubelskie	Lublin	Lublin
Lubuskie	Gorzów Wielkopolski	Gorzów Wielkopolski
	Zielona Góra	Zielona Góra
Małopolskie	Crakow	Crakow
Mazowieckie	Warsaw	Warsaw
Opolskie	Opole	Opole
Podkarpackie	Rzeszów	Rzeszów
Podlaskie	Białystok	Białystok
Pomorskie	Tricity	Gdańsk
		Gdynia
		Sopot
Śląskie	GZM	Katowice
		13 cities of GZM
Świętokrzyskie	Kielce	Kielce
Warmińsko-mazurskie	Olsztyn	Olsztyn
Wielkopolskie	Poznań	Poznań
Zachodniopomorskie	Szczecin	Szczecin

Note: 13 cities of the GMZ Metropolitan Area include: Bytom, Chorzów, Dąbrowa Górnicza, Gliwice, Jaworzno, Mysłowice, Piekary Śląskie, Ruda Śląska, Siemianowice Śląskie, Sosnowiec, Świętochłowice, Tychy and Zabrze.

E Validation study design

Table A5: Validation study sample design with assumed sample sizes by country, gender, and age

Country	Gender	Age	Assumed sample size
Poland	Female	18-24	90
		25-29	80
		30-39	40
		40	40
	Male	18-24	90
		25-29	80
		30-39	40
		40	40
Ukraine	Female	18-24	50
		25-29	45
		30-39	25
		40	25
	Male	18-24	50
		25-29	45
		30-39	25
		40	25
Belarus	Female	18-24	40
		25-29	35
		30-39	15
		40	15
	Male	18-24	40
		25-29	35
		30-39	15
		40	15

F Additional characteristics – parents and students

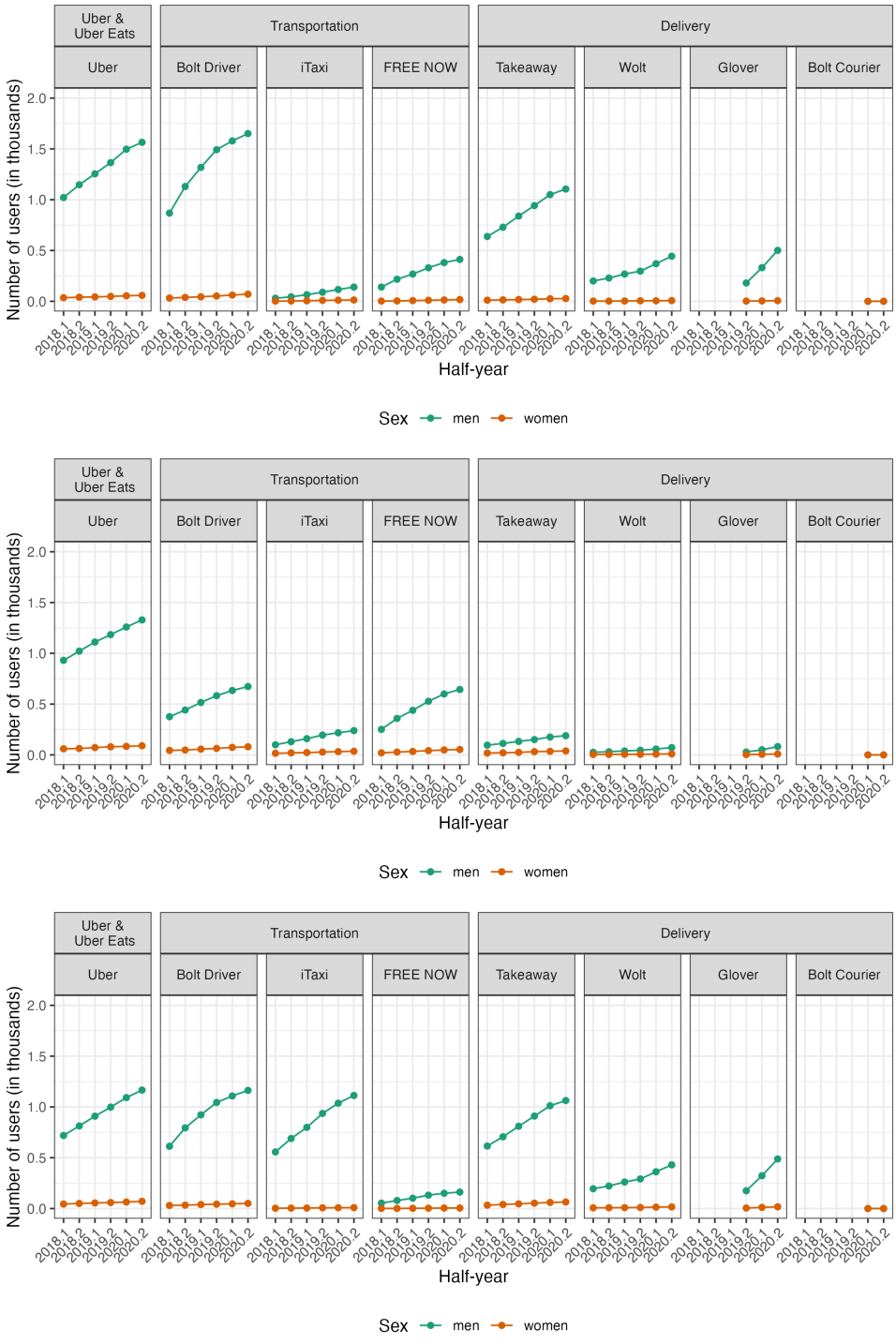

Figure 10: The monthly number of active users of selected apps in Poland by gender and being a parent of 0-4 child/children (top), a parent of 5-10 child/children (middle) and a student 2018 and 2020

G Selected results at the level of cities, functional urban areas and provinces levels

Details for Warsaw (capital city)

Table A6: Number of active users in Warsaw, all cities and in Poland for 2020HY2

App	Warsaw	All Cities	Poland	Warsaw % of total	Cities % of total
Uber & Uber eats					
Uber	12,637	27,868	46,054	27.4	60.5
Transportation					
Bolt Driver	7,799	16,878	38,855	20.1	43.4
iTaxi	3,692	10,024	25,345	14.6	39.6
FREE NOW	2,954	5,692	21,573	13.7	26.4
Delivery					
Takeaway	1,878	13,563	13,910	13.5	97.5
Wolt	1,956	5,060	5,645	34.7	89.6
Glover	2,358	5,906	6,482	36.4	91.1
Bolt Courier	533	1,168	1,243	42.9	94.0

Note: Warsaw % of total is calculated as Warsaw to Total, Cities % of total is calculated as All Cities to Total. All Cities include those listed in Table A4 except for the 13 cities of GMZ.

G.1 Detailed information about all cities in 2020HY2

Table A7: Number of active users in cities for 2020HY2

	Transport				Delivery			
City	Uber	Bolt	iTaxi	FREENOW	Takeaway	Wolt	Glover	Bolt
Białystok	–	–	96	–	630	205	56	24
Bydgoszcz	–	274	178	–	297	101	71	12
Gdańsk	472	542	104	450	778	156	170	32
Gdynia	479	401	373	120	245	48	53	10
Gorzów Wlkp	–	–	178	–	311	27	15	5
Katowice	1578	–	482	–	558	106	121	21
Kielce	–	–	12	–	442	75	65	18
Crakow	6808	4166	994	1219	1619	792	893	170
Łódź	1762	793	405	230	908	140	261	33
Lublin	–	–	344	–	958	226	187	18
Olsztyn	–	–	190	–	533	90	122	20
Opole	–	–	310	–	912	238	204	30
Poznań	835	701	506	64	1288	350	410	62
Rzeszów	–	–	41	–	459	169	36	22
Sopot	80	249	179	35	196	38	42	8
Szczecin	–	–	461	–	387	52	254	55
Toruń	–	336	370	–	276	94	66	11
Warsaw	12637	7799	3692	2954	1878	1956	2358	533
Wrocław	3217	1617	931	620	540	165	505	78
Zielona Góra	–	–	178	–	348	32	17	6

H Activity of apps as proxy for working time

We investigate the mean and standard deviation[13] of time spent in the app during working days (Mondays-Thursdays) and at weekends (Fridays-Sundays), in the daytime (8:00–18:00) and at nighttime (18:00-8:00) over 2020 HY1. Figure 11 presents changes in the trends for these descriptive statistics. Delivery riders tend to be more active on working days and during the day. A reverse pattern can be observed at weekends, when more intensive activity takes place at night. This is to be expected since at weekends interest in transport services tends to increase at night, when more people are engaged in entertainment activity. However, working at night can be a serious problem when it comes to work-life balance. As regards transportation services, the average time spent in apps on weekdays is longer during the day compared to nighttime hours. At weekends, the level of activity during the day is similar to that observed at night.

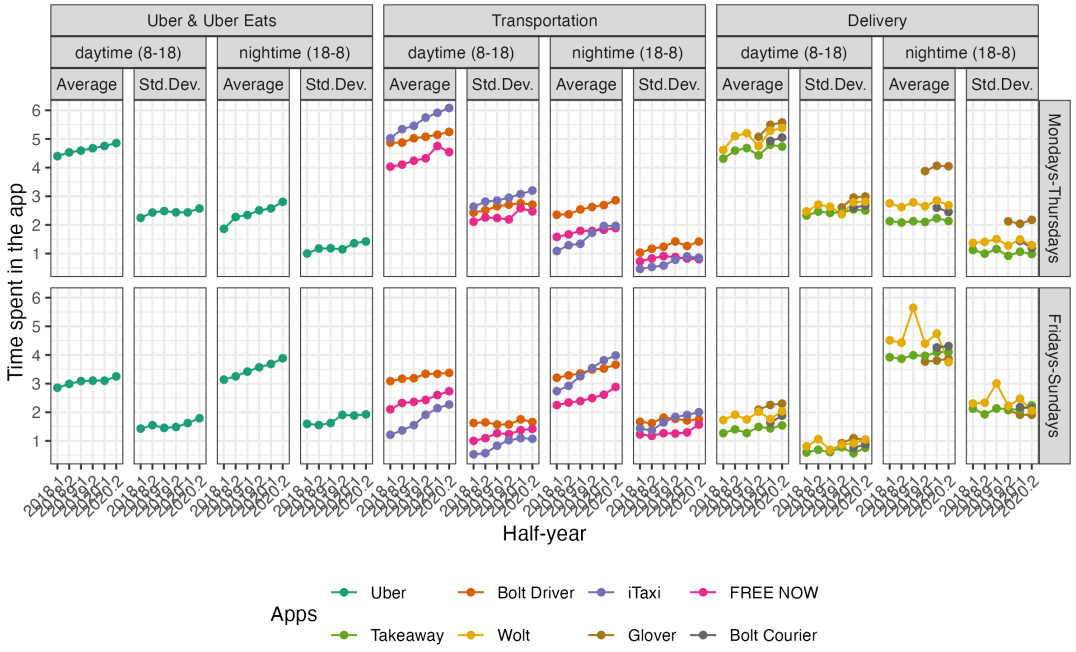

Figure 11: The mean and standard deviation (Std. Dev.) of time spent in the app by app type, app, days of the week and time of day

[13]The standard deviation allows us to quantify the variability in working time between users of the same app for a given part of the day (daytime, nighttime) within a six-month period. It is calculated as follows: for a given app, we aggregate the time spent in the app during nights and then calculate the standard deviation of these times.

I Labour Force Survey

LFS results are generalised for the population using calibration weights, which are constructed in three steps. The purpose of the first step is to compensate for disproportions in the sample structure. This is done by calculating primary weights of dwellings (treated as households), which are defined as reciprocals of their selection probabilities.

During the second step, refusals are taken into account by calculating response rates for 6 different size categories of localities in each province. The response rates are defined as ratios of the sum of primary weights of surveyed households to the sum of primary weights of households that qualified to be surveyed. Final household weights are obtained by multiplying primary weights by reciprocals of corresponding response rates.

The goal of the third step is to ensure consistency with demographic estimates. This is achieved by adjusting secondary weights of surveyed respondents (final household weights assigned to individual household members) so that they correctly sum up to population counts in 48 categories cross-classified by the place of residence (urban/rural), sex and 12 age groups in each province. To this end, within each cross-classification a factor is calculated, which is given as the ratio of the population count in each cross-classification (known from current demographic estimates) to the sum of secondary weights of respondents in a given cross-classification. Final weights of respondents are obtained by multiplying secondary weights of respondents by an appropriate factor.

The variance of estimators in the LFS is estimated by using the bootstrap method. A detailed description of the approach applied to complex two-stage sampling designs, can be found in the monograph by Shao and Tu (2012).

Table A8: Direct estimates,their standard errors (in thousands) and sample sizes of the working population size (aged 18–64) based on the LFS data from between 2018HY1 to 2020HY

	2018HY1			2018HY2			2019HY1			2019HY2			2020HY1		
City	$\hat{N}$	$SE(\hat{N})$	n	$\hat{N}$	$SE(\hat{N})$	n	$\hat{N}$	$SE(\hat{N})$	n	$\hat{N}$	$SE(\hat{N})$	n	$\hat{N}$	$SE(\hat{N})$	n
Białystok	132.2	2.9	988	132.4	11.5	934	128.2	0.6	892	138.9	1.6	879	127.4	0.1	845
Bydgoszcz	175.9	20.2	1359	170.4	24.0	1250	165.5	13.4	1179	163.3	20.2	1046	183.6	27.9	1052
Gdańsk	180.5	33.0	847	190.5	42.3	842	207.0	16.4	852	206.6	36.4	807	170.3	40.9	660
Gdynia	142.7	3.9	363	145.1	14.4	351	134.8	8.1	326	132.4	6.9	292	145.3	33.5	319
Gorzów Wlkp	67.0	9.8	1002	59.0	13.8	809	63.4	5.9	848	53.9	11.7	722	52.8	9.2	713
Katowice	139.1	29.5	819	142.3	20.4	725	150.3	16.9	705	167.4	37.0	690	155.5	23.7	661
Kielce	84.7	16.5	869	88.9	22.6	870	86.4	19.0	884	86.8	29.6	867	89.0	17.9	807
Crakow	408.0	15.3	904	418.3	20.3	793	415.6	63.3	776	430.5	53.5	756	360.8	63.2	640
Lublin	176.0	20.7	1371	167.6	19.2	1195	162.8	26.5	1156	153.0	30.4	1033	160.0	33.7	1022
Łódź	328.5	16.1	637	334.3	16.9	510	291.5	1.8	489	298.3	18.2	448	238.7	63.0	442
Olsztyn	79.5	18.7	959	83.3	27.2	967	76.4	25.9	891	83.6	22.9	878	82.5	20.2	953
Opole	55.5	16.5	786	59.8	11.8	800	60.1	16.3	841	56.4	15.5	782	54.1	17.6	870
Poznań	268.5	41.9	893	269.0	64.9	841	259.0	28.7	774	278.1	65.1	719	232.6	53.5	785
Rzeszów	101.8	22.9	1050	105.3	31.8	1022	107.5	30.7	1095	104.7	27.0	991	91.1	33.2	1052
Sopot	6.0	17.4	16	4.2	23.8	10	7.0	12.8	17	3.4	10.4	8	3.5	10.7	8
Szczecin	200.5	37.1	1147	196.2	20.5	1055	205.0	14.0	951	189.3	25.8	759	191.1	9.2	671
Toruń	91.5	12.8	1176	98.8	10.0	1211	92.3	14.7	1055	95.2	14.4	1039	95.8	11.4	916
Warsaw	968.2	26.8	1827	978.5	63.5	1677	899.7	28.9	1660	944.8	19.4	1445	909.2	50.7	1454
Wrocław	320.9	61.2	858	350.5	49.1	1006	343.2	67.8	977	342.2	92.4	833	314.6	97.0	805
Zielona Góra	63.9	11.0	856	65.9	10.9	810	65.2	16.0	784	65.9	12.3	790	68.5	13.9	811