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Use of the Lorenz curve in transport research

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LORENZE CURVE

Concentration curve

A representation of the uneven distribution of some quantity – typically income, population, other characteristics, including characteristics associated with space

Distribution characteristics or spatial variability

- It shows the size of the area in which a certain part of the studied characteristic is concentrated.
- A characteristic is more concentrated where a larger proportion of it is concentrated in a smaller proportion of the area.

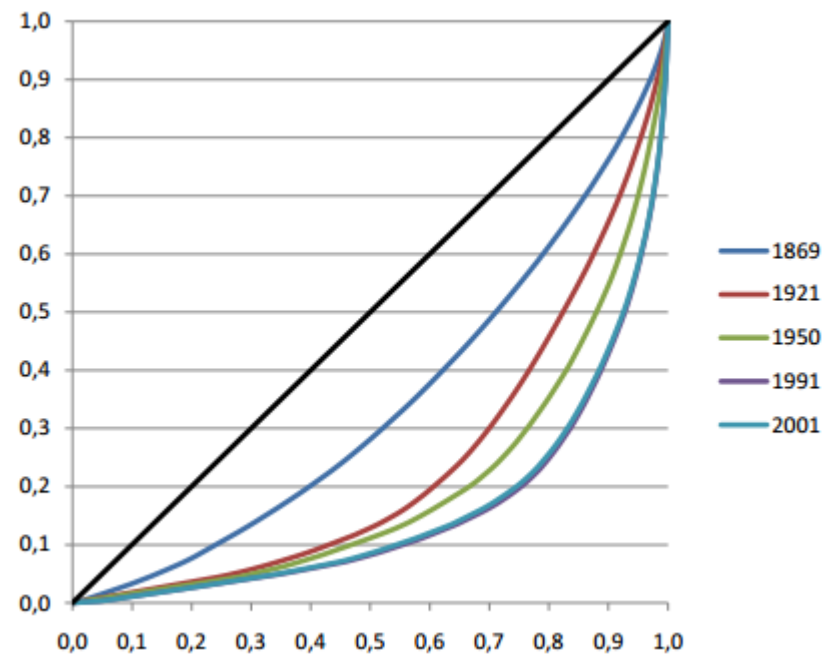
LORENZE CURVE

Y-axis – cumulated areas of territorial units, sorted in descending order by the intensity of the monitored phenomenon, i.e. by general density

X-axis – cumulative shares of the characteristic in the corresponding territorial units

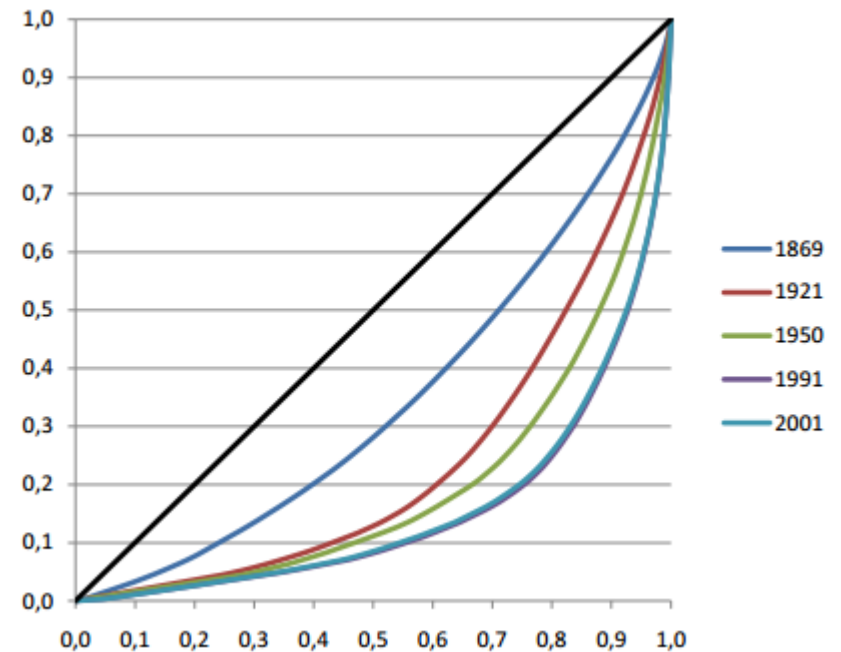
After constructing the concentration curve, it is easy to read how many percent of the monitored characteristic is concentrated, for example, on 25, 50, 75% of the area.

LORENZE CURVE MORAVIAN-SILECIAN REGION

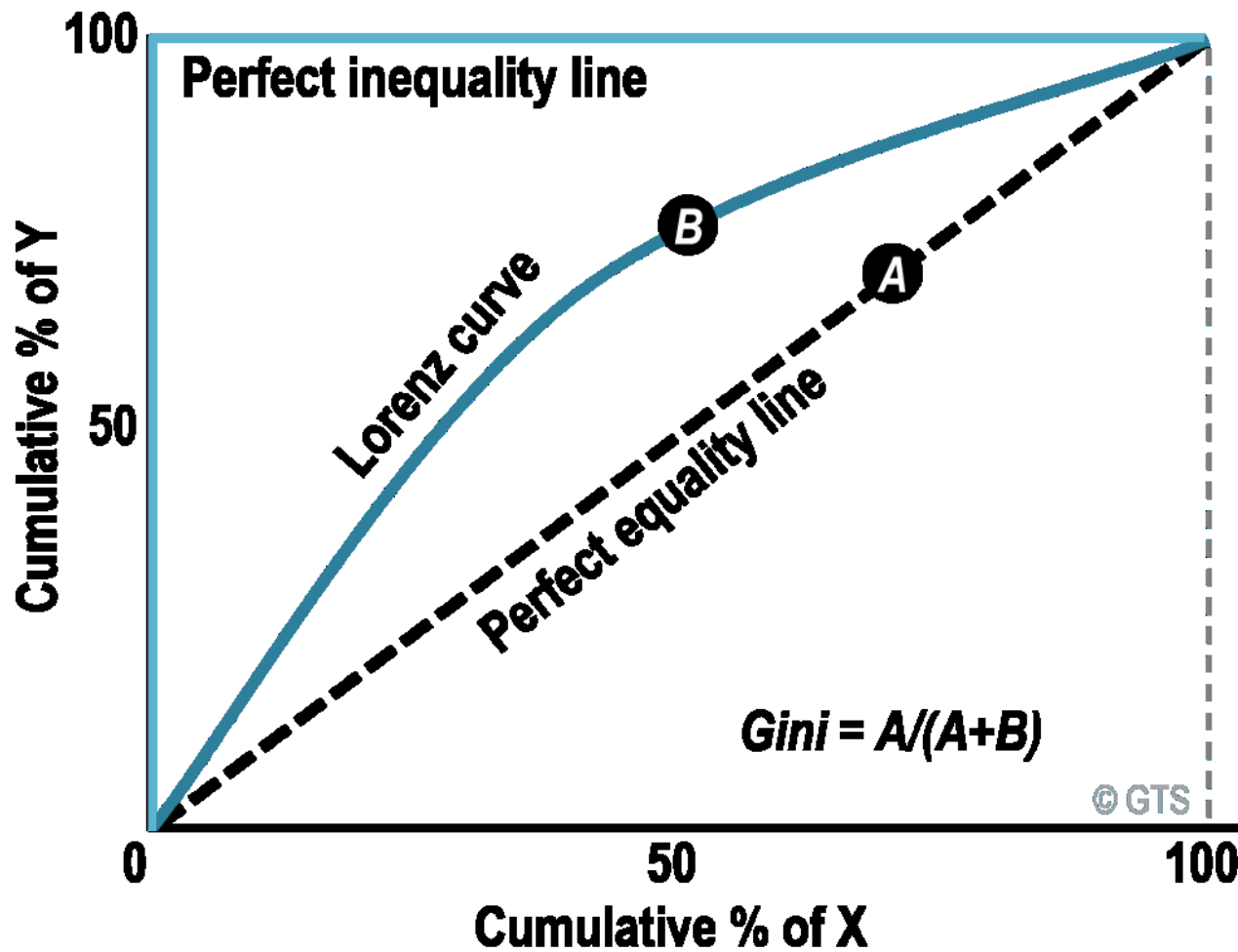


LORENZE CURVE MORAVIAN-SILECIAN REGION

The more the curve deviates from the diagonal, the higher the population concentration. If the population were evenly distributed in the territory, the concentration curve would converge with the diagonal (exactly 50% of the population would live on 50% of the territory, etc.)



LORENZE CURVE



CONSTRUCTION OF THE LORENZ CURVE

1. Density calculation (per km²)
2. Sorting territorial units by density in descending order (also possible in ascending order, then the axes in the graph are reversed)
3. Calculation of relative frequencies for the selected characteristic and area
4. Cumulative counting of relative frequencies
5. Scatter chart

USE OF THE LORENZ CURVE IN TRANSPORT

Possibility of evaluating a number of transport characteristics, e.g.:

- **Uneven use of infrastructure**

- **Example:** Share of roads in total traffic volume.
- The Lorenz curve will show that, for example, 20% of roads carry 80% of the traffic load – i.e. a strong concentration of traffic

- **Emission or noise distribution**

- **Example:** Uneven distribution of CO₂ emissions from transport by city district.
- It shows that only small parts of the city produce most of the emissions – e.g. due to traffic hubs

- **Inequality in access to transport services**

- **Example:** Distribution of public transport availability among residents (e.g. by distance to stops or frequency of connections).
- The Lorenz curve can be used to make social inequalities in transport accessibility visible

- **Inequality in individual population mobility**

- **Example:** Use of different transport modes or distance travelled in a population.
- For example, a small group of residents (e.g. long-distance commuters) performs most of the transport performance

CONSTRUCTION OF THE LORENZ CURVE

First, construct a Lorenz curve on sample data (population example)
– see the following slides

The detailed procedure is described on the following slides.

PUBLIC DATABASE – OWN CHOICE

[HTTPS://VDB.CZSO.CZ/VDBVO2/](https://vdb.czso.cz/vdbvo2/)

1. Výběr ukazatele 2. Výběr území 3. Výběr období 4. Uspořádání 5. Zobrazení dat

- Obchod, pohostinství, ubytování
- [-] Obyvatelstvo
 - Počet obyvatel ((trvalý pobyt))
 - celkem [1]
 - Pohlaví [2]
 - Věk (produkční skupiny) [3]
 - Věk (5 leté skupiny) [21]
 - Pohlaví a věk (5 leté skupiny) [42]
 - Pohlaví a věk (produkční skupiny) [6]
- [-] Území, sídelní struktura
 - plocha území (ha)
 - celkem [1]
 - druh plochy [12]
 - koeficient ekologické stability [1]

Vybrané ukazatele

- //Počet obyvatel ((trvalý pobyt))//celkem [1]
- //plocha území (ha)//celkem [1]

Selected pointer moved using the button to the selection in the right window

PUBLIC DATABASE – OWN CHOICE

Statistiky Vše o území

Úvod > Vlastní výběr

Sestavení vlastní tabulky

1. Výběr ukazatele 2. **Výběr území** 3. Výběr

Území

[Česká republika](#)

[Regiony soudržnosti](#)

[Hlavní město Praha + Středočeský kraj](#)

[Kraje](#)

[Okresy](#)

[Správní obvody obcí s rozšířenou působností](#)

[Obce](#)

[Další typy](#)

Výběr území -

Filtrovat seznam:

Filtrovat podle textu:

Kód	Název
554979	Abertamy (okres Karlovy Vary)
506486	Boží Dar (okres Karlovy Vary)
500127	Doupovské Hradiště (okres Karlovy Vary)
538159	Hájek (okres Karlovy Vary)
555169	Horní Blatná (okres Karlovy Vary)
555185	Hroznětín (okres Karlovy Vary)
555215	Jáchymov (okres Karlovy Vary)
578045	Krásný Les (okres Karlovy Vary)
555363	Merklín (okres Karlovy Vary)
555428	Ostrov (okres Karlovy Vary)
555452	Pernink (okres Karlovy Vary)
555479	Potůčky (okres Karlovy Vary)
555584	Stráž nad Ohří (okres Karlovy Vary)
555703	Velichov (okres Karlovy Vary)
555738	Voikovice (okres Karlovy Vary)

Počet položek: 15

To select municipalities, select the option Municipalities and in the pop-up window Filter list: Administrative districts of municipalities with extended jurisdiction - here I select my ORP → Select all → OK
Continue following the instructions in the database.

ASSIGNMENT FOR EXAMPLE IN A HOUR

	Počet obyvatel	Rozloha (v km ²)	Hustota osídlení	Počet obyvatel (v %)	Rozloha (v %)	Fi obyvatelé	Fi rozloha
Ostrov	17 089	50,4					
Abertamy	1 118	8,7					
Horní Blatná	473	5,6					
Hroznětín	1 943	23,8					
Jáchymov	2 755	50,8					
Pernink	649	15,7					
Potůčky	456	32,0					
Boží Dar	216	37,9					
Celkem	24 699	225					

Input data from the database – area converted from hectares to km²

CALCULATION PROCEDURE FOR THE LORENZ CURVE

	Počet obyvatel	Rozloha (v km ²)	Hustota osídlení	Počet obyvatel (v %)	Rozloha (v %)	Fi obyvatelé	Fi rozloha
Ostrov	17 089	50,4	339,02				
Abertamy	1 118	8,7	128,55				
Horní Blatná	473	5,6	84,07				
Hroznětín	1 943	23,8	81,68				
Jáchymov	2 755	50,8	54,26				
Pernink	649	15,7	41,30				
Potůčky	456	32,0	14,25				
Boží Dar	216	37,9	5,70				
Celkem	24 699	225	109,81				



Population/Area (inhabitants/km²)

Then sort by population density in descending order

CALCULATION PROCEDURE FOR THE LORENZ CURVE

	Počet obyvatel	Rozloha (v km ²)	Hustota osídlení	Počet obyvatel (v %)	Rozloha (v %)	Fi obyvatelé	Fi rozloha
Ostrov	17 089	50,4	339,02	69,19	22,41		
Abertamy	1 118	8,7	128,55	4,53	3,87		
Horní Blatná	473	5,6	84,07	1,92	2,50		
Hroznětín	1 943	23,8	81,68	7,87	10,58		
Jáchymov	2 755	50,8	54,26	11,15	22,57		
Pernink	649	15,7	41,30	2,63	6,99		
Potůčky	456	32,0	14,25	1,85	14,23		
Boží Dar	216	37,9	5,70	0,87	16,86		
Celkem	24 699	225	109,81	100,00	100,00		



Relative structure

- Share of population in individual municipalities in the total population in the ORP
- Share of the area of individual municipalities in the total area of the ORP

CALCULATION PROCEDURE FOR THE LORENZ CURVE

	Počet obyvatel	Rozloha (v km ²)	Hustota osídlení	Počet obyvatel (v %)	Rozloha (v %)	Fi obyvatelé	Fi rozloha
Ostrov	17 089	50,4	339,02	69,19	22,41	69,19	22,41
Abertamy	1 118	8,7	128,55	4,53	3,87	73,72	26,28
Horní Blatná	473	5,6	84,07	1,92	2,50	75,63	28,78
Hroznětín	1 943	23,8	81,68	7,87	10,58	83,50	39,36
Jáchymov	2 755	50,8	54,26	11,15	22,57	94,65	61,93
Pernink	649	15,7	41,30	2,63	6,99	97,28	68,92
Potůčky	456	32,0	14,25	1,85	14,23	99,13	83,14
Boží Dar	216	37,9	5,70	0,87	16,86	100,00	100,00
Celkem	24 699	225	109,81	100,00	100,00		



Cumulative frequencies – gradual addition of relative frequencies, the sum must always reach 100% in the end

CONSTRUCTION OF THE LORENZ CURVE

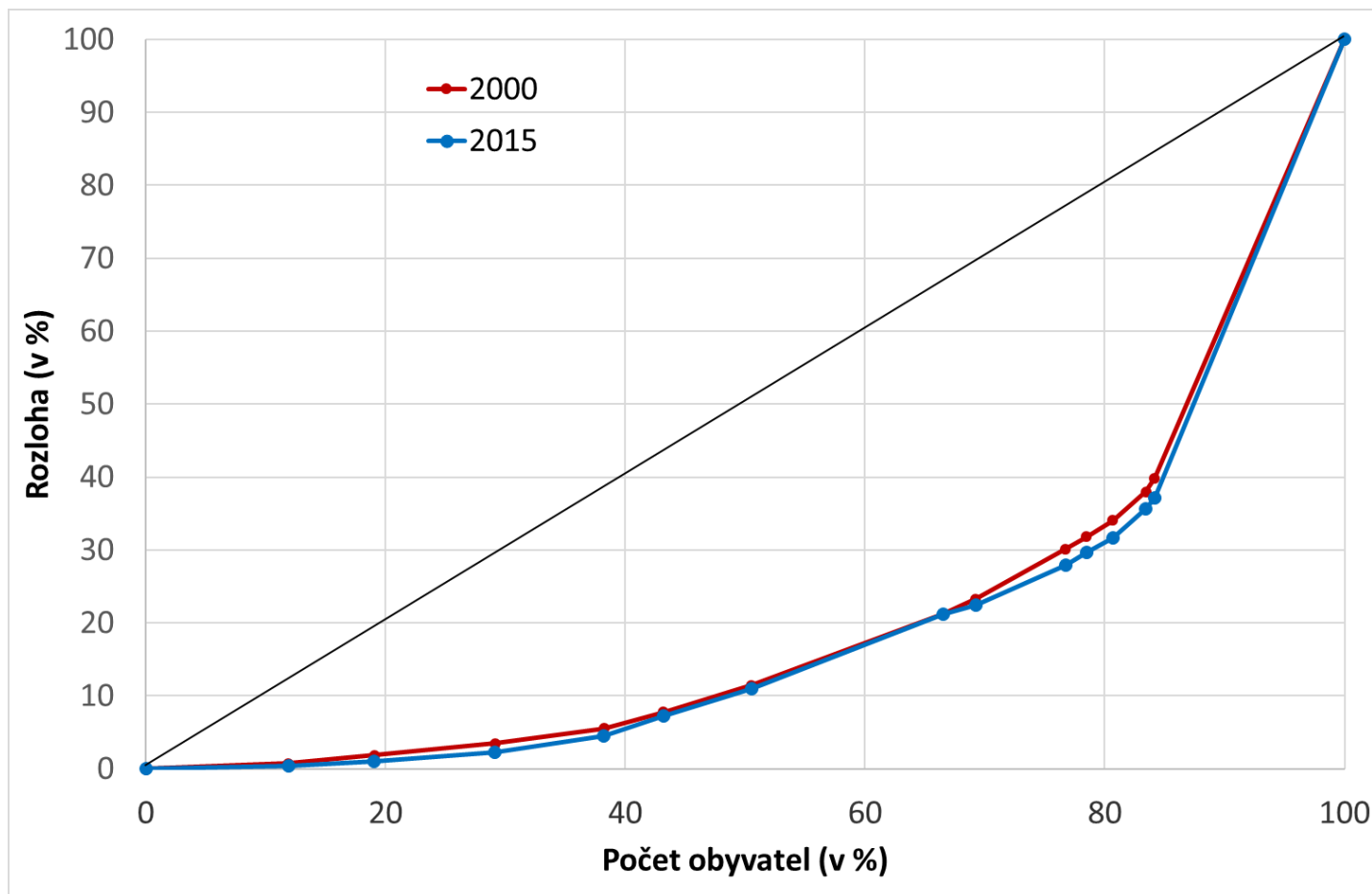
We then plot the cumulative frequencies on a graph

- ❑ Scatter plot (individual cumulative frequencies as x and y coordinates)
- ❑ The points can then be connected by a line

Lorenz curve always below the diagonal

- ❑ When sorted by density in descending order – on the x-axis, cumulative population density
- ❑ When sorted by population density in ascending order – on the x-axis, cumulative frequency of area

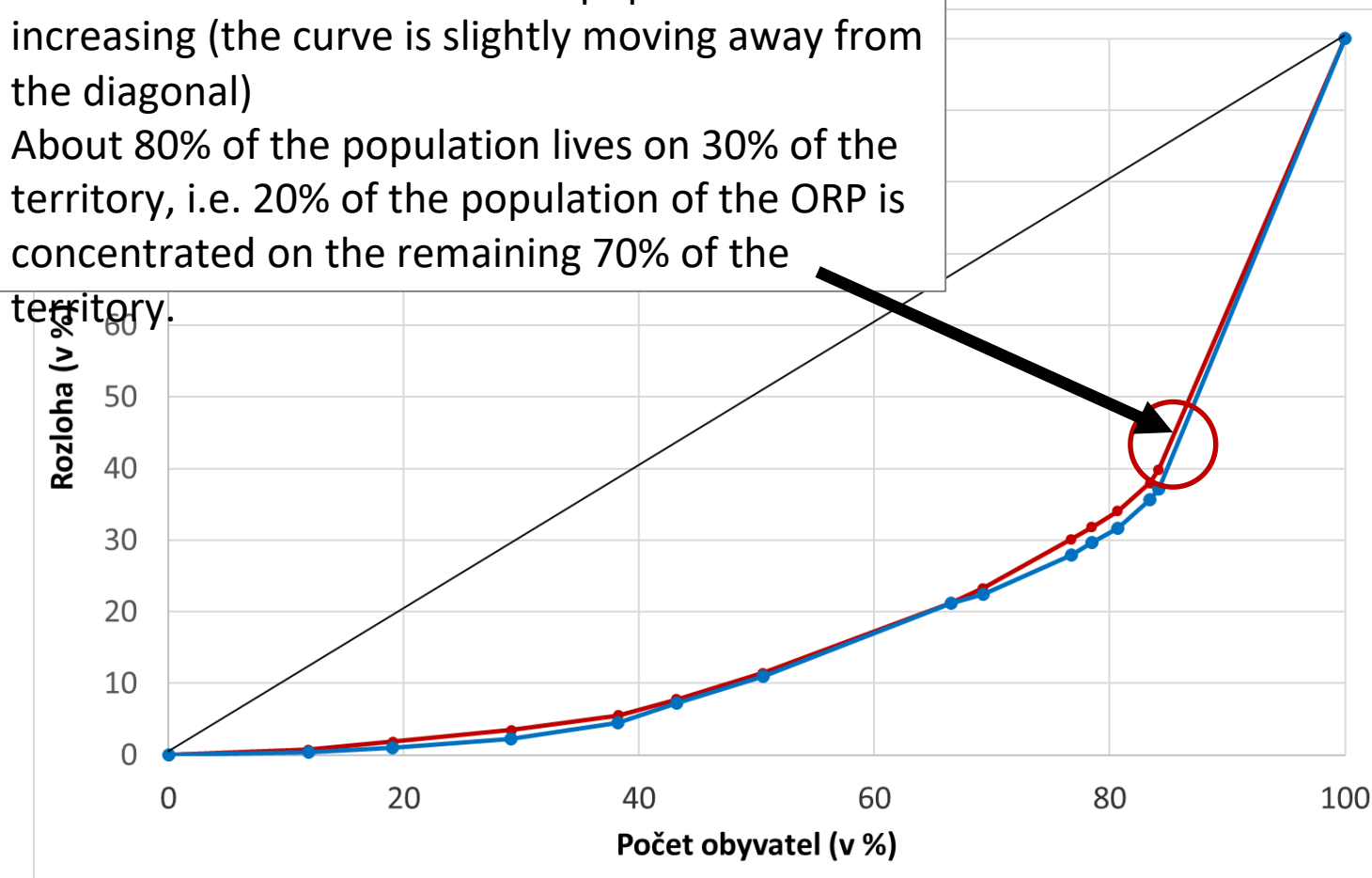
LORENZE CURVE, ORP OSTROV, 2000 AND 2015



Source: Czech Statistical Office. 2015

LORENZE CURVE, ORP OSTROV, 2000 AND 2015

The uneven distribution of the population is increasing (the curve is slightly moving away from the diagonal)
About 80% of the population lives on 30% of the territory, i.e. 20% of the population of the ORP is concentrated on the remaining 70% of the territory.



Source: Czech Statistical Office. 2015