

Assignment 3

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2022-11-10

Introduction to Data

The data that I have chosen is **Technology Adoption** and can be downloaded from this

link

. This data provides very useful insights and statistics on each country's development and adoption of technology.

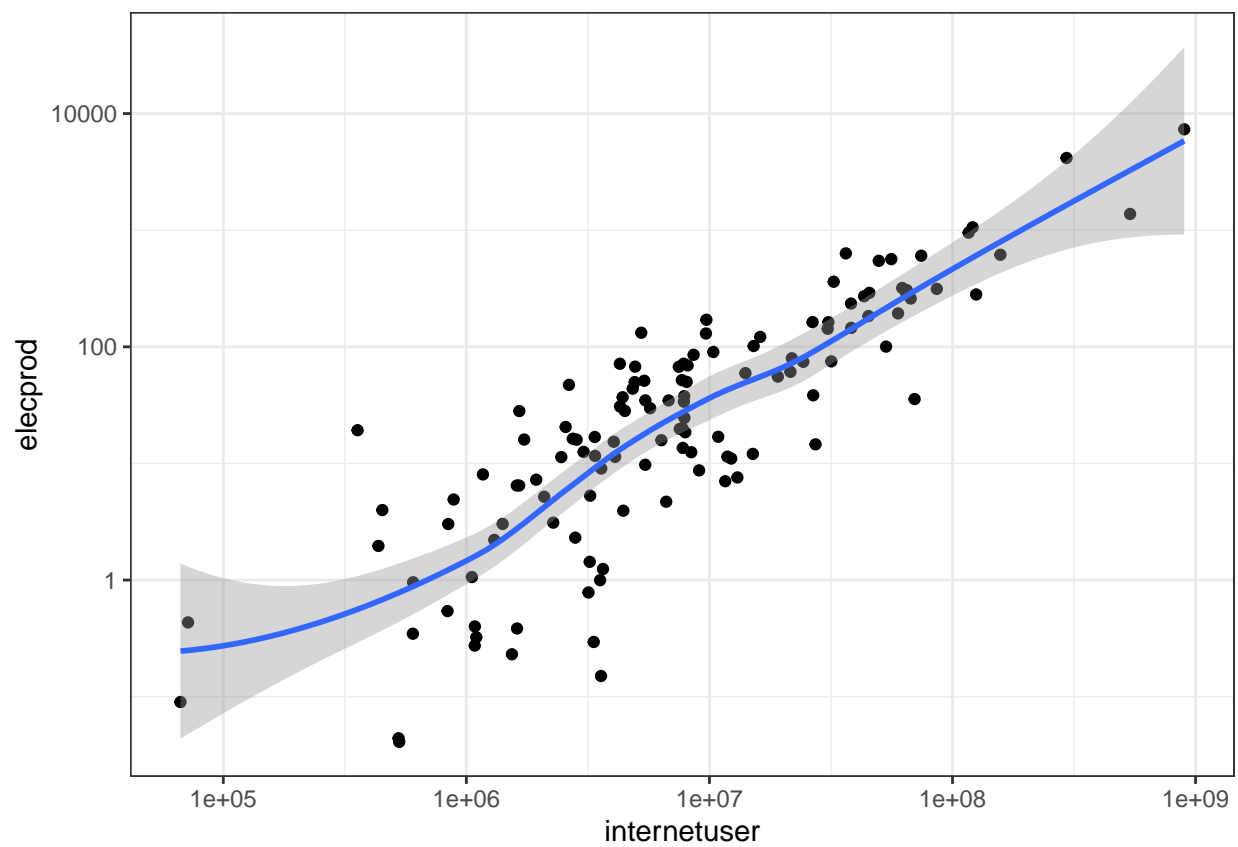
variable	label	iso3c	year	group	category	value
BCG	% children who received a BCG immunization	AFG	1982	Consumption	Vaccines	10.000
ag_harvester	Combine harvesters - threshers in use	AFG	2001	Production	Agriculture	2.000
all_vehicles	Total vehicles (OICA)	AFG	2005	Consumption	Transport	660000.000
aluminum	Aluminum primary production, in metric tons	ALB	1850	Production	Industry	0.000
atm	ATMs	ABW	2011	Consumption	Financial	90.000
bed_acute	Beds for those seeking in-patient acute care	AUS	1960	Non-Tech	Other	67000.000
bed_hosp	Beds in hospitals	AFG	1960	Non-Tech	Hospital (non-drug medical)	1677.093
cabletv	Households that subscribe to cable	AFG	1992	Consumption	Communications	0.000
elec_coal	Electricity from coal (TWH)	ABW	2000	Production	Energy	0.000

There are 491636 observations and 7 rows in this dataset.

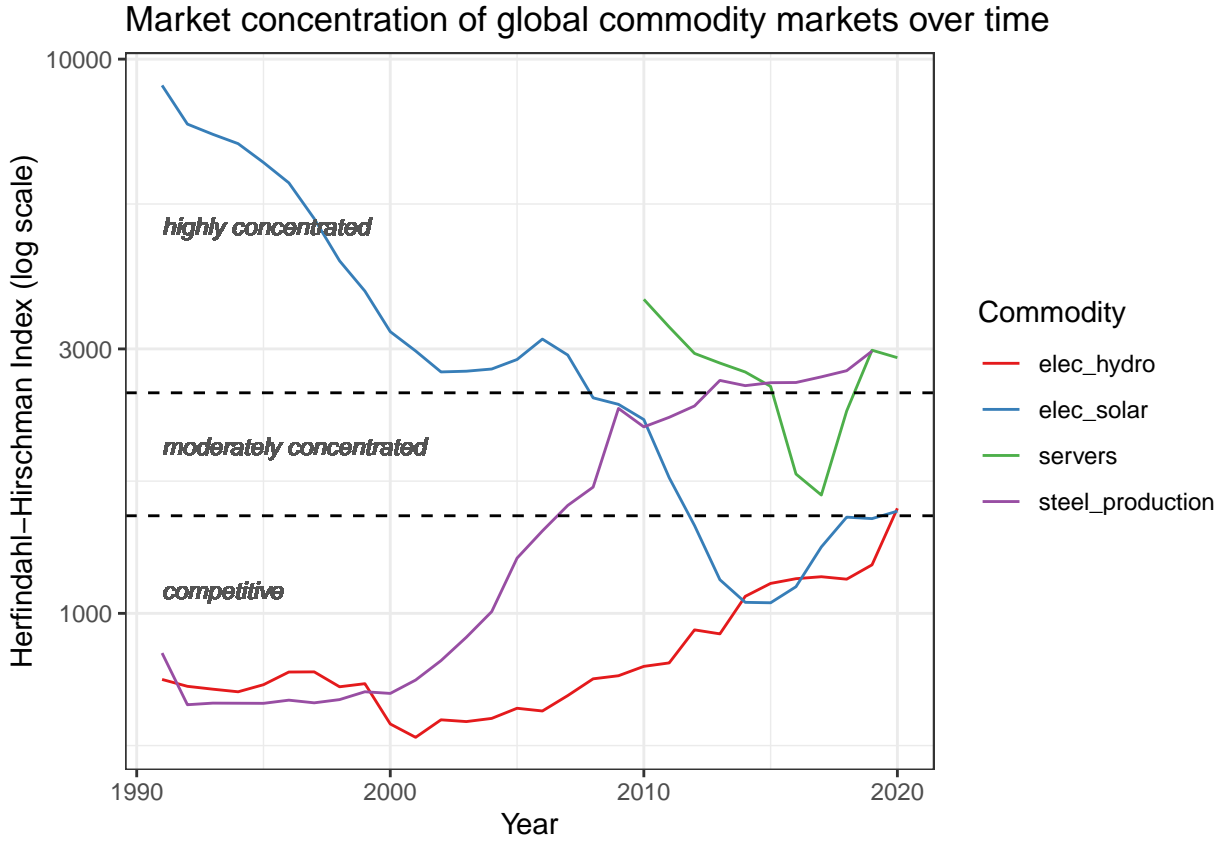
1. **variable**: variable name
2. **label**: explanation on what the variable is and what it measures
3. **iso3c**: country code
4. **year**
5. **group**: there are four groups that each variable can be classified as
 - Consumption: technologies that directly increase the consumer's utility
 - Production: technologies involving goods and services that consumers buy
 - Creation: involves research and development process of technologies
 - Non-tech: not involving technologies
6. **category**:
7. **value**: value of the statistics measured

Plot 1

```
## `geom_smooth()` using method = 'loess' and formula 'y ~ x'
```



Plot 2



In this plot, we calculated the Herfindahl-Hirschman Index (HHI) for each commodity in the global market to measure market concentration over time. HHI can be defined as

$$HHI = \sum_{i=1}^n s_i^2$$

where s_i is the market share percentage of firm i expressed as a whole number, not a decimal (Source: Investopedia.com). The maximum value of HHI is $100^2 = 10000$ which is only achievable if the market is a pure monopoly.

As HHI increases, market concentration is higher which means there is less competition and can be interpreted as monopoly/oligopoly. Similarly, lower HHI means lower market concentration which leads to higher competition as the market is closer to the perfect competition model. The interpretation of HHI is as follows:

- Highly concentrated: $HHI \geq 2500$
- Moderately concentrated: $1500 \leq HHI < 2500$
- Competitive: $HHI < 1500$

We would like to measure HHI of global commodities to determine the competitiveness of various markets where each country acts as a firm/supplier. We measure the market share of each country by taking the amount produced divided by global total production. From Plot 2, we can see that market concentrations of various global commodities have significantly changed from over 30 years ago.

- For the market of electricity produced by hydrotechnology, the market still remained competitive in 2019, albeit there has been a slow increase in concentration since the early 2000's. Interestingly, there was a huge jump in market concentration in 2020 so the market is now moderately concentrated.
- For the market of electricity produced by solar technology, the market concentration has drastically decreased from highly concentrated to borderline

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References