Data Visualisation COM-480
Milestone I

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I. PROBLEMATIC AND DATASET

A. Context

In the context of the 2022 French presidential election, the subject of minimum wages and working hours has been brought back to the centre of the public debate by candidates and their parties.

Various scenarios are envisioned. Some parties promote an increase in wages without affecting working time while others support overtime work. Still, others think that income should be maintained but with less work for example by advocating for a 4-day week. These questions are all linked to the same topic: how to increase the general well-being of the population while maintaining productivity and keeping a strong economy?

This project aims to document voters by answering the previously listed questions on the international level through concise but informative data analyses and visualisations. This will give them a factual understanding of the topic and allow a critical view of politicians' promises.

Some other questions that the study will help to answer concern the impact of working time on Gross Domestic Product (GDP), inequalities among workers, the productivity of the country, and living standards. And, can we work less without affecting the economic dynamics?

To meet this goal we consider key variables (further detailed in the following) in a selection of EU countries and major economic powers (Switzerland, the US etc...) through the past decades.

B. Dataset

The full dataset used for this project is a combination of nine sets from the Organisation for Economic Co-operation and Development (OECD) website, each representing a measure for each OECD country on a range of years. This study focuses only on OECD countries to avoid potential confounding factors that would appear by mixing socio-economically too different countries. These are a selection of EU countries for which there exists data for the 9 measures : all of the 27 countries but Croatia, Bulgaria, Romania, Malta, Cyprus.

The nine sets can be divided into the three following subtopics table I.

If time permits, another selection of non EU countries might be analysed and the results visualised as well. This selection would count at least Australia, Canada, Korea, Norway, Great Britain, the US.

II. EXPLORATORY DATA ANALYSIS

A. Pre-processing

Processing our data is relatively simple, as the OECD data sets are already quite clear and uniform. The measures from the datasets have been given the following acronyms :

- **hrs_wk** := total number of hours actually worked per year divided by the average number of people in employment per year.
- **avg_wg** := Average wages
- **hrs_pvty** := weekly hours that a family claiming guaranteed minimum benefit needs to work to exit poverty. Several classes of households can be chosen
- **GDPhrs_wk** := GDP per hour worked
- **GDPcapContr_x** := Labour productivity, measured as growth in GDP per hour worked
- **GDPcapContr_y** := labour utilisation, measured as changes in hours worked per capita
- **wg_actvy** := wage per sector of activity (agriculture, industry, service or 'total')
- **income_ineq** := income inequality. Several coefficients are proposed to compute the inequality (Gini coefficient, Interdecile P50/P10, Interdecile P90/P10, Interdecile P90/P50, Palma ratio,S80/S20 quintile share)
- **poverty** := poverty rate among age classes (Total, 0-17 year-olds, 18-65 year-olds, 66 year-olds or more)
- **emp_rate** := employment rate (doesn't appear in the matrix as the measure is not done yearly)

In order to get first insights on the data, choices had to be made when it comes to categories. Indeed, several dataset allowed to select between social classes, methods of calculation.

- **hrs_pvty** := single with no child and hours at 67% average wage. This guaranteed enough data for each of the countries of interest for a first analysis.
- **GDPhrs_wk** := the unit chosen was the US dollar among the suggested ones, as it is historically a reference currency

Working hours and incomes in the country	Impact on the productivity of the country	Impact on living standard
Average wages [1]	GDP per hour worked [2]	Income inequality [3]
Employee compensation by activity [4]	Labour productivity and utilisation [5]	Poverty rate [6]
Hours worked [7]		Working hours needed to exit poverty [8]
		Employment rate [9]

TABLE I: Data sets used from the OECD database.

- **wg_actvy** := the 'total' category was chosen to keep a general overview.
- **income_ineq** := The coefficient chosen is Gini's.
- **poverty** := the "total" category was chosen, again to keep generality

B. First results

1) Year 2018: Following the previously listed choices the correlation matrix of the variable can be computed fig. 1. Here we selected year 2018 as it is the most recent year with enough data among all the data sets.
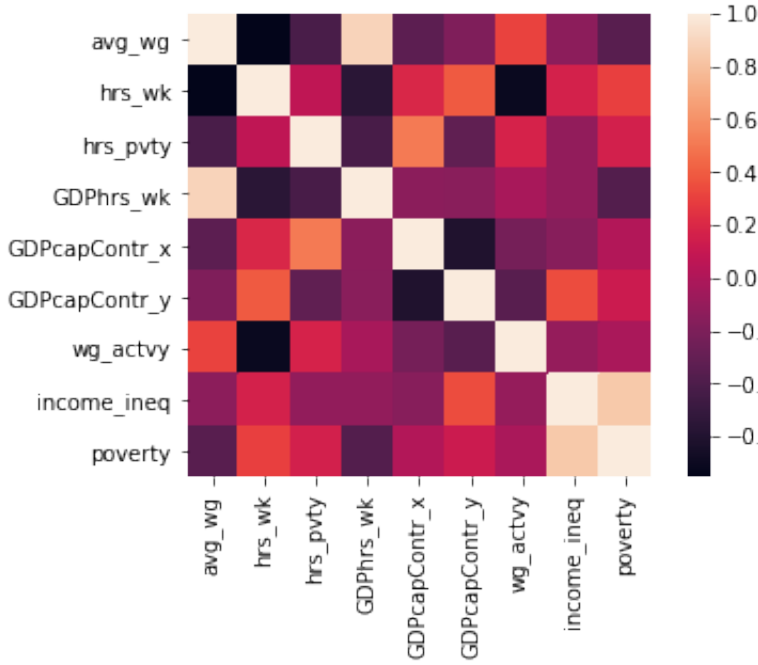

Fig. 1: Representation of the correlation matrix of measures over EU countries. Year of interest is 2018. Data from the OECD.

The correlation matrix already gives us insights on our problematic. On the side of **negative** correlations [1]:

- strong between average wages and the number of hours worked

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[1]As a quick reminder, in statistics, a perfect negative correlation is represented by the value -1.0, while a 0 indicates no correlation, and +1.0 indicates a perfect positive correlation. A perfect negative correlation means the relationship that exists between two variables is exactly opposite all of the time.

- wage per sector of activity and the hours of work
- labor productivity with the labour utilisation
- GDP per hour worked with total hours worked

On the side if **positive** correlations :

- GDP per hour worked with average wage
- income inequality and poverty

2) Evolution of working hours: Working hours are also changing over time: one can see on figure 2 the evolution of working time in three European countries: Switzerland, France and Germany. One can easily see that the trend has been decreasing for 30 years, with correlation factors between year and working time close to -1 (a Pearson coefficient of -0.94 for Switzerland).
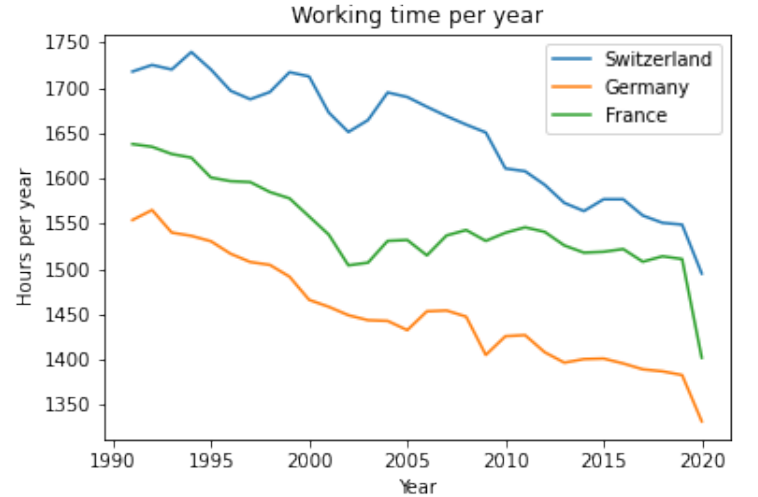

Fig. 2: Evolution of working hours per year in Switzerland, France and Germany from 1991 to nowadays. Data from the OECD [7].

III. RELATED WORK

The effect of minimum wage on employment, GDP and worked hours is a recurrent subject within research on the economy. It is largely discussed yet it remains hard to draw large-scale conclusions as it depends on factors that vary across countries, industries or activity sectors, or population categories (workers' age category, social class, wealth...), hence making it challenging to compare precise studies together [10], [11]. A pattern often noticed

is that the effects of minimum wages on employment are either hard to measure or when they exist, are small [12], [13]. The mechanisms involved behind minimum wage policies, or behind the increase of minimum wage, are also mentioned to explain why the effects of a minimum wage are ambiguous. Indeed, if increasing the minimum wage might directly bring more earnings to workers, the question of who pays for this increase can also indirectly have a negative impact on workers - i.e. whether the increase is paid by consumers or by firm owners, who in consequence would respond by higher demands on working hours or decrease in employment [14].

Finally, the literature keeps us aware that we should treat large-scale, cross-country data with carefulness, as we might encounter variables whose definition varies between countries at stake (e.g. income data might refer to income before tax or disposable income) [15]. We must also keep in mind that secondary datasets such as the World Income Inequality Database ([16]) or the Deininger and Squire database ([17]), that encompass data from a large set of countries like we do such as GCB or Gini coefficients, summarize several variables that can suffer from definitions variation and might lead to interpretation mistakes [15].

In the context of our approach, OECD countries have already been compared to each other and over large periods of time on the subject of the number of working hours [18], [19], inequality evolution [20] or productivity [21]. Our attempt tries to compare selected variables on a time scale covering more recent data.

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