Impact of the Covid-19 pandemic on unemployment in selected countries and country groups*

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The economic crisis caused by Covid-19 differs from previous economic crises in several ways. It is a global event that developed unexpectedly and hit the world unprepared, primarily attacking human resources, requiring strong governmental measures. The involvement of the human sphere directly affected people's income and lives through labour market effects. Based on literature and statistical data, this study analyses the evolution of the unemployment data of 11 countries (Australia, Chile, the UK, Israel, Japan, China, Hungary, Germany, Italy, Turkey, and the US) and two country groups (EU-27 and the Organisation for Economic Co-operation and Development – OECD) during the economic crisis. Based on the results, the authors identified three distinct groups of countries with 1. moderate growth, slow consolidation; 2. robustious upturn, fast then slow correction, and 3. individual patterns. The study demonstrated how government measures took effect differently from the unemployment perspective. The authors referred to the influence of the inhabitants' collective way of thinking and considered it essential to emphasise the positive impact of vaccines.

Introduction

Coronavirus disease (Covid-19) which originated in China at the end of December 2019 became a pandemic in 2020 and it marked the beginning of a new era in a multitude of fields in our lives. The same holds true for the economy as well, wherein we had to face a hitherto unknown type of economic crisis (Cooper–Szreter 2021). Previous general depressions were caused by overproduction, uneven distribution of income (Berkin et al. 2015), overheated granting of loans (Baily et al. 2011), and systematic and regulatory errors, and the corresponding loss of faith (Claessens et al. 2010). Previous disease-related crises were either of universal proportions like the Spanish flu (but the economy was not globalised then) or only caused local crises like the Ebola and avian influenza. This pandemic has also brought about a worldwide halt or very poor performance of different branches, such as tourism or catering (Flór 2020, Gossling et al. 2021).

Lessons learned from such outbreaks should to be borne in mind (Asquith 2020, Beach et al. 2020, Diamond 2019). Covid-19 has forced the global economy to come to a standstill, resulting in both a drop in demand and shrinking reproduction that has hit developing and transitioning economies particularly hard (Ayhan–Ohnsorge 2020).

As Covid-19 infects people and therefore, human resources, short-term control and prevention measures were the primary defence before the discovery of vaccines. These measures led to job stoppages and closures, further increases in inequality, and intermittent increases in unemployment (Butterick–Charlwood 2021). While rising unemployment has caused problems in all countries, these have occurred to a degree that depends on the condition and performance of individual economies (European Commission 2021, Jackson et al. 2021). In the present study, we examine the evolution of unemployment data on each continent, focusing on countries that have been particularly affected by the pandemic or have responded to the situation with emergency measures.

Literature review

Here, we review how the pandemic has influenced the labour market and the development of unemployment data.

Gomme (2020) modelled the probable effects of Covid-19 on the labour market. The model followed the principles of Diamond-Mortensen–Pissarides (1994), which were founded on the difficulties of employers and employees in matching with each other. According to Gomme (2020), Covid-19 is expected to directly affect the economy for 18 months, during which the following exogenous phenomena are to be reckoned with:

- The probability of working (employment) falls by a quarter, which is much higher than that during the Great Depression;

- recruitment costs are doubled; and
- a 10% drop in productivity is expected owing to reduced work efficiency at home and supply chain disruptions.

Based on this, the economic outlook is daunting – the model predicts that the unemployment rate will rise above 22% and output will fall by 20%. It is now clear that Gomme's (2020) forecast showed a more unfavourable picture than the real events. Even in the most difficult period, the increase in unemployment remained below 20% in the second quarter of 2020, and for the whole year it was 8.8% (ILO Monitor 2021). Even today, we cannot precisely determine the duration of the economic downturn caused by the pandemic, as news about new virus variants and exacerbations is constantly coming in.

There are four labour market responses to offset the above effects.

- The introduction of a 50% wage subsidy reduces unemployment and alleviates production decline.
- The combined application of wage subsidies and employment guarantees, which would mean an initial 10% increase in the unemployment rate and then a gradual decline to 3.5% before the economic crisis, would assume a 14% decline in output. This is the most effective response to an economic crisis.
- Providing more generous unemployment benefits (this is not very effective because it does not lead to a fall in the unemployment rate).
- Guaranteeing a 50% subsidy for the cost of filling vacancies, which would reduce unemployment by up to 20%.

It should be noted that what is described are true for 2021; but in 2021, unemployment would not rise as described and economic growth would have turned positive in various parts of the world. This could be owing to the respective government's intensive economic and labour market support policies (IMF 2021).

According to the generally accepted definition of the International Labour Organization (ILO) (Insee 2021), a person qualifies as unemployed if they do not work during the reference week because they have no job but is at disposal, that is,

- they can take on a job in the next two weeks, or
- they have been looking for or have found a job position in the last four weeks that they could hold within three months.

The number of people who are part of the active working age group but do not work or look for a job for some reason (e.g. patients, householders, dependents) is increasing. However, the ILO definition is not clearly applicable to a pandemic. Owing to the closures, it was not possible to look for a job; on the contrary, many people were waiting for their company to reopen because they were promised that they would be needed again. This situation is typical in the US, where affected individuals are considered unemployed from the moment their jobs are terminated (USBL 2021). In the UK, the same people, if they have a live employment contract, are considered to be in active employment, even if they do not have to go to work for a month or are not

paid. In Australia, laid-off workers are not considered unemployed until four weeks have elapsed since the last pay was made (Tetlow et al. 2020).

A thirty-country analysis of the global economic consequences of a pandemic (Fernandes 2020) draws attention to the fact that

- the pandemic is truly global,
- and not just lower-income countries are involved,
- our world is more globalised than before,
- interest rates are at historic lows,
- supply chains have collapsed, and
- both demand and production decreased.

This can be explained by the listed factors: for example, for Germany, the correlation coefficient between Covid-19 mortality and unemployment data is 0.88. In addition, the proportions of the world economy are different, as it was 20 years ago, during the time of the bird flu. China's share of global gross domestic product (GDP) was 2.3% in 1980, up from 18.3% in 2017 (Textor 2021). Thus, this value has increased eightfold in the last nearly forty years, with only one country contributing 40% to world GDP growth, while contribution of the US has fallen from 24% to 15.3% (Morrison 2019). Today, China is the largest importer, exporter, and component manufacturer. These facts projected in the first quarter of 2020 the danger that China's recession could drag on the world economy as the centre of the pandemic. Fortunately, these concerns have not materialised. China's GDP finally produced a positive growth of 2.3% in 2020, after a significant decline in the second quarter [4]. The performance of financial markets also declined significantly (by 25–50%), and fluctuations in the values of key stock market indices broke historic highs. However, as a result of regulatory and central banking activities in recent years, the reported downturns have not caused major anomalies (ISDA 2021).

After the epidemic escalated into a pandemic in spring 2020, the impact of the closures reflected in the second-quarter statistics. According to ILO (2021), the global loss of working hours was 18.2% in the second quarter, equivalent to the loss of 525 million full-time jobs worldwide. However, the number of job losses was higher owing to the following reasons: a large number of part-time workers became unemployed and the special conditions of the ILO definition mentioned earlier. Fortunately, protection measures have been successful in many countries; therefore, the global loss of working hours was more favourable on an annual basis, with an annual value of 8.8% in 2020. It had a successful job protection program, e.g. Germany, UK and France. In these countries, unemployment did not increase as drastically in the second quarter of 2020 as, for example, in the USA or Canada (Pope–Hourston 2022). The lost hours mainly affected the more economically developed continental European continent. For North and South Americas, the annual rate was 13.7%, while in Europe (including Central Asia), it was 9.2%. Some of the hours lost are actual job losses, ranging from 2.7% (America) to 0.2% (Africa).

Additional lost working hours are forced inactivity and reduced working hours. The latter, a key form of saving jobs, accounted for roughly half of the global time lost. In the countries of the Organisation for Economic Co-operation and Development (OECD), unemployment increased from 5.4% to 9.2% in the first quarter of 2020. In the second wave, growth continued, and is estimated to have reached 12.5% (Lai et al. 2021). The data are often compared between the US and The Great Depression of 1929–1933. However, experts find that "those job losses were permanent. They were jobs that were lost and gone forever" (Iacurci 2020).

Long-term UK GDP time series have demonstrated (Rodríguez-Caballero–Vera-Valdés 2020) that epidemics dampen economic growth and increase unemployment. Their results also point out that without job-saving policies, the unemployment rate will be higher and long-term. They also emphasise the importance of appropriate timing of measures, showing that saving jobs is less time-consuming and costly than reintegrating already unemployed workers into the labour market.

The ILO's unemployment rate for the global economy by 2020 is 4.3% (ILO 2021). Men over the age of 25 lost the most jobs, while women and young people aged 15–24 were more likely to be inactive. According to ILO (2021), the pandemic also reduced the number of working hours in Europe to 23 million (Figure 1). Owing to restrictions, 10% of jobs were closed in 2020, and the rate of teleworking increased to 15% (Fana et al. 2020).

Figure 1

Working hour losses in Europe in 2020

Equivalent number of full-time jobs
(48 hours/week) lost (millions)
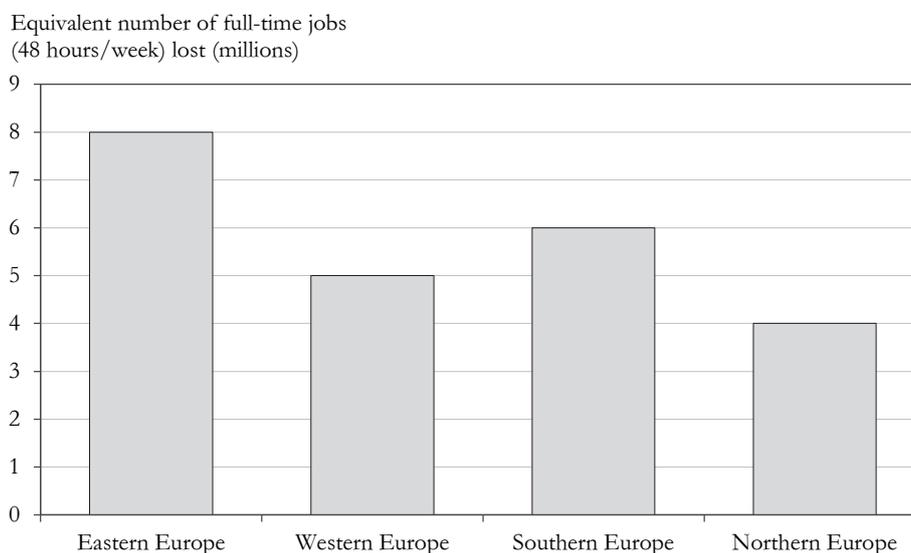
Source: ILO (2021).

The closures owing to the pandemic have affected different sectors of the economy in different ways and to different degrees. Among the countries in Western Europe (Su et al. 2021), the UK (Bell–Blanchflower 2020, Chung et al. 2021, Fana et al. 2020, Mangan 2020, Rodríguez-Caballero–Vera-Valdés 2020, Tetlow et al. 2020), Italy (Fana et al. 2020, ItStat 2020, Meraviglia–Dudka 2021, Sanfelici 2020, Strauss–Kahn 2020), and Germany (Bauer–Weber 2021, Fana et al. 2020, Liu et al. 2021) were characterized by a high infection rate.

The restrictive measures were aimed primarily at preventing community spread, with some workplaces switching to teleworking and introducing health precautions in essential on-call work. Owing to these restrictions, the protests that led to violence later became permanent (Kuras 2020). Meanwhile, the apparent freedom of summer laid the foundation for the second wave. Vaccination was already available at the end of December, but in Germany, vaccination started were two weeks after that in the UK (Geinitz 2021). This delay contributed to a further tightening at the end of January, which is now linked to the third wave. The austerity and vaccination campaign resulted in mitigations in the summer; however, owing to a total vaccination rate of only 42%, the delta variant of the virus is likely to lead to a fourth wave (Oltermann 2021).

In the UK, the unemployment rate was 4% in February 2020 (1.36 million people), and 20.2% of the population was economically inactive. As a result of the restrictions, 11% of jobs were closed, bringing the proportion of teleworkers to 40%. For women, this situation increased the burden of domestic work and raising children by nearly 50%, which in turn reduced their work performance. Those who maintained their jobs reported a 40% drop in income, which had a noticeable impact on family finances. As a result of the restrictions introduced in time and the increased job search support that preceded them, the proportion of applicants increased from 9 to 15% in three months; simultaneously, as a result of government measures, the proportion of lost working hours fell by 18% and unemployment by 4%. From January to March 2021, under severe constraints, the unemployment rate was only 4.8% (King 2021). In March, the unemployment rate fell again (Partington 2021). The UK was the first to launch a vaccination campaign on 8 December 2020 (BBC 2020). Owing to successful defence and significant vaccination, the government planned an opening in early summer, but the delta virus variant, which appeared in May and triggered a third wave, thwarted that plan (Morton–Faulkner 2021).

In Italy, the overall unemployment rate was 9.5% in 2019, with 10–50% among young workers depending on the region. The proportion of participants with an inactive working age was 34.7%. As a result of preventive restrictions, 11% of jobs were closed and the rate of teleworking increased to 35%. Owing to the lockdown restrictions in March, the number of hours worked fell by 28% in the first month of the economic crisis, a 42% decline from the same period last year. All these data can be judged by the fact that 86.4% of Italian women worked at home regardless of the

pandemic, meaning that they ran a household and raised children. Considering Italy's death toll in 2020, the country has become a sad European record holder (Ruffino 2021). The country was not in a better position to grow. The Italian economy closed in 2020 with a loss of 8.9% of GDP, the second largest in Europe after an 11% decline in Spain (AFP 2021a).

Hungary was characterised by stable economic growth and improved employment data before the pandemic. The number of unemployed people has been steadily declining, and in 2019, the unemployment rate fell to 3.3%. A quarter of the unemployed came from the 15–24 age group (Adó Online 2020). In preparation for Hungary's involvement, the government established an operational tribunal on 31 January 2020. The government announced an economic action program to protect income and jobs, with job support, tax breaks, and a credit moratorium, and to purchase protective equipment and respirators in preparation for further deterioration (hirado.hu 2020). The pandemic had a significant impact on small- and medium-sized Hungarian enterprises. It is important to examine how the performance of companies has changed, especially to understand the effects of received financial support on companies' activities. Foreign-owned companies that operate in this region can have a positive effect on employment. Foreign direct investments can create jobs that can mitigate the adverse effects of unemployment, even in the event of an unfavourable economic situation (Antalóczy et al. 2022).

In the second wave, when healthcare was better prepared for the pandemic, less stringent protection measures were introduced, among other things, to keep the economy afloat. However, the number of people diagnosed with Covid-19 increased again from November, so epidemiological tightening had to be re-imposed. The restrictions particularly affected men's jobs, with the number of hours they worked falling by 9% during the first wave and those of women by 1%. When evaluating these data, it should be borne in mind that the domestic definition of unemployment is based on the ILO definition described above, and therefore temporarily inactive labour is not considered. On 26 December 2020, ahead of the other countries of the continent, the vaccination program started in Hungary and Slovakia (Kőműves et al. 2020), which allowed the economy and everyday life to restart. However, as the desire to vaccinate is significantly reduced, and vaccination is still far from the 85% required for herd immunity, experts expect the delta variant and the fourth wave to appear in the fall (24 April 2021). This had already happened at the time of closing the manuscript.

In Asia (APESO 2020, ASEAN 2020, Morris–Weidenkaff 2020), the pandemic significantly reduced the number of hours worked, reversed the growth trend in employment and led to the loss of 81 million jobs. South Asia was hit the hardest by the downturn. The highest unemployment rates were in India (7.1%) and the Maldives (7.2%) in this region (ADB 2021), where women and young workers lost their jobs. Half of the region's workers work in the sectors most affected (hospitality,

trade, assembly, transport, and construction), with guest workers, in particular, losing their jobs. 24% of young workers under the age of 35 years in Asia are unemployed, but this is only the average, compared to 13% for men and 36% for women. In the first quarter of 2020, the number of redundancies converted to full-time equivalents amounted to nearly 120 million jobs, which doubled by the end of the second quarter.

Of the countries on the continent, Japan (CEIC 2021, Lai et al. 2021, Mártonffy 2021, Morris–Weidenkaff 2020) is one of the most affected countries but has chosen an individual approach to the pandemic. In the case of Japan, as well as other Asian countries (South Korea and Taiwan), some observers (Bradley 2020) argued that a common culture of obedience, general purity, and Confucianism explains why it was more successful in containing viral infections. In Japan, the healthcare system developed in the 1920s was radically improved in 1961, which also contributed significantly to lower infection rates (Le–Kim 2020). On 30 January 2020 former Prime Minister Abe Shinzo established the Japanese National Task Force on Coronavirus to oversee the government's response to the epidemic (Thorn 2020). Until April, they focused primarily on the repatriation of Japanese nationals, restrictions on entry, and, in part, the development of healthcare. The vaccination coverage of the country was very low. By February 2021, the unemployment rate had increased to 2.6%, more than what was before the epidemic. Japan was the last to start its vaccination program among economically developed states, with national vaccination rates still low (Kosaka et al. 2021).

The situation of China among the countries of the continent is unique (Barwick et al. 2020, Bloomberg 2020, CEIC 2021, Fernandes 2020, Morris–Weidenkaff 2020, Subbaraman–Varma 2020). As this country experienced the first outbreak, everything happened sooner than in any other country in the world, and China did not have time to prepare. Despite these facts, the Chinese economy achieved 2.3% growth by the end of 2020 (Bradsher 2021, Cheng 2021). However, it is not a unique case in the world. In addition to some African countries, Ireland, as the only EU member state, closed 2020 with 3.4% growth. In the absence of other measures, only strict short-term measures can be implemented. As a result of Covid-19 deaths in China, the number of active workers decreased by five million between January and February 2020. By April, the actual unemployment rate had fallen to 20.5% and nearly 7 million people were at risk of losing their jobs. However, this change was only the mean. In China's most developed provinces, the unemployment rate rose from 25 to 65% in the first three quarters of 2020, depending on the involvement of each sector. The official unemployment rate for the urban population is 5.1%, but it does not include nearly 30 million guest workers who were unable to return to work in Japan owing to forced restrictions. Hong Kong's situation was significantly better, with an unemployment rate of 9.3% at the end of 2019, rising to 10.1%. Among the young people, this figure changed from 2.7% to 3.8%. In addition to rising unemployment, income had also fallen significantly. Of those who retained their jobs, 59% reported

a decline in income. The data have improved significantly since October 2020, and the pre-pandemic unemployment rate has recovered.

In Turkey, which connects Europe to Asia (CEIC 2021, Kati 2021, Teague 2021, Turak 2021), the unemployment rate was 13% at the start of the pandemic in March 2020, rising rapidly to 14.4% by July. It then returned to the pre-pandemic levels in August 2020. Currently, the unemployment rate is 13.4%. Compared to 2019, the level of employment decreased by 2.5%age points in one year compared to 3% for workers under 25 years of age. Although Turkey had one of the highest unemployment rates in the OECD before the pandemic, it dealt with the problem better than some other OECD countries, despite the impact of Covid-19. In the US, for example, the unemployment rate rose from 3.5% in February to 14.7% in April, and was even higher than in Turkey in April 2020. In contrast, Turkey's unemployment rate rose slightly to 1.7%, peaking at 14.3% in June. At the end of May 2021, owing to the rapid rise in disease, the Turkish government decided on repeated restrictions. Therefore, the population was worried about unemployment and inflation. During the pandemic, Turkey faced economic problems. This naturally affected the number of visitors to the country, which also affected the labour market (Bayramov 2022).

In the Americas (Bell–Blanchflower 2020, Fernandes 2020, ILO 2021, Lund et al. 2020, Teague 2021, Tetlow et al. 2020), the unemployment rate also increased significantly, averaging 13.7% in 2020. The unemployment rate rose to 9.2% in North America and 16% in Latin America and the Caribbean. In the US, more than 10 million jobs were lost in the first quarter of 2020, up from 6.7 million in the last week of March alone. From mid-March to mid-April 2020, the unemployment rate rose from 3.5% to 14.7% and the proportion of jobs at risk was another 32%, indicating that one in six Americans were unemployed. This condition is expected to return to pre-Covid-19 levels by 2022 owing to less prevalence of the disease. The proportion of new unemployed was particularly high in three groups: those who worked part-time (46%), those under 35 (50%), and women who lost 55% of their jobs. The decline in income is also significant on this continent, with 48% of those who have a job remaining affected.

In the US, the official unemployment rate rose from 3.5% in February to 14.7% in mid-April. The real unemployment rate is likely to be closer to 19% if the statistics include the additional eight million people leaving the labour market. Unlike in Australia or the UK, in the US, restrictions were introduced first and only then they increased job search support. As a result, the proportion of beneficiaries increased from 3 to 18% in the first two months of closure. Covid-19 appeared in the southern part of the continent later compared to Europe and the US. For example, the unemployment rate in Chile began to increase in April 2020. It peaked at 4%age points in three months from an initial 9%, then declined steadily until December, stabilising at approximately 10.3%.

The pandemic favoured Australia (Bessant–Watts 2021, CEIC 2021, Guven et al. 2020, Morris–Weidenkaff 2020, Tetlow et al. 2020) and resulted in an end to quarter-on-year GDP growth of 3.2% per year. The country defended itself effectively against short-term restrictions during both the first and second waves, so unemployment rose by just 1%age point from 6.4% in the second quarter of 2020 to 7% in October during the second wave. Since then, the rate has been steadily declining, reaching 5.6% in July 2022 [1]. Among young people, this figure rose from 3.7% to 4.1%. The rate among young people is 8%age points higher than that among adults. As a result of job closures, one-third of workers and managers, a total of 4.3 million workers, switched to work from home. In September 2020, statistics reported one million unemployed, one and a half million jobseekers, and the same number of workers with shorter working hours. The proportion of people working part-time increased to 13.7%. The reduction in working hours mainly affected workers under 35 years of age. Married, more skilled workers with children suffered less from the downturn, with only 24.4% being able to take up casual work. The average number of hours worked fell by an average of 9.8%, which also had serious consequences for wage cuts. As a result of increased job search support prior to the restrictions, the proportion of applicants for support increased from 6 to 12% in two months.

Based on a 2021 review, the pandemic resulted in a 3.2% decline in employment, a 4% increase in the full-time unemployment rate, a 1% increase in the total unemployment rate, and the introduction of an average of two-hour-short working hours per week. Covid-19-related closures have significantly reduced labour market participation and working hours, as well as increased unemployment, job retention insecurity, and job-related vulnerability and workload. Of the significant interactions, the interaction between Covid and teleworking increased labour market participation rates, and the interaction between Covid and education reduced unemployment, meaning that those with higher education were less at risk in the event of a dismissal.

Among the former Commonwealth countries, data from the UK and Australia were compared in a study by Tetlow et al. (2020). Unemployment has risen less sharply in the UK and Australia, whose governments have spent much earlier on protecting jobs rather than providing aid. In contrast, the increase in the unemployment rate was much higher in the US, where government support for the unemployed has increased significantly, especially for those made redundant.

In Australia, the share of the labour force claiming unemployment benefits increased by about six%age points between the end of February and the end of April. Official figures for mid-April point to an unemployment rate of 6.2%, predicting a rise to 9.8%, including those who left the labour market between March and April. Finally, official unemployment figures peaked at 7.4%. Simultaneously, there was a nine-%age-point increase in the proportion of households in the UK that had at least one active member and applied for a general-purpose loan between mid-February and the end of April 2020.

Methodology

Data and methods

In our analysis, we asked how much the situation induced by the Covid-19 pandemic impacted the unemployment rate on various continents. We used a publicly available long labour market time series for this study. The data were obtained from the OECD database [2], in the event that the examined time series were not complete on the above website at the time of the writing of this article. We supplemented it from the website of Trading Economics [3] (Chile: April 2021, UK: March–April 2021, Turkey: February–April 2021, China: complete time series).

We chose the AutoRegressive Integrated Moving Average (ARIMA) procedure as it provides an opportunity to make short-term forecasts, even if the time series contain trends or show seasonality. The condition is that the time series should be made stationary. This was ensured by derivation (integration), by filtering out the trends. Of course, the timelines of individual countries differ, as different domestic events occur at different places. Global changes, such as rising unemployment owing to pandemic restrictions, appear in all-country models. First, based on the Akaike criterion (AIC), we determined the most optimal seasonal ARIMA (if necessary) model that showed the most accurate fit with the time series of monthly unemployment data from January 2010 to December 2019. Since Covid-19 started in China, it could have been present there even before. Therefore, the pre-pandemic period was extended from January 2010 to September 2019. Finding the optimal model also involved the necessary Box-Cox transformation (normalisation). Furthermore, if a trend-like change could be detected during the period under review, its extent was also estimated and incorporated into the model ("drift"). As our primary goal was prediction, we used the Ljung-Box test as the basis for judging the fitted models. Among the 12 time series cases we modelled, only in one case (Turkey) did the indicator show a significant deviation from the time series values; in the other cases, it was within the acceptable range (Table A1 in the Appendix). A similar approach is used in Kapás's (2022) study, in which she examines whether the pandemic will affect the unemployment rate in the long term as well. She used the ARIMA model based on the time series of the unemployment rate in her study.

Based on the stochastic time-series model of the period before the pandemic outbreak, we estimated the period from January 2020 (September 2019 for China) to April 2021. We then compared the projected monthly unemployment data with the observed values, so that the effect of pandemic became detectable. All calculations were performed using RStudio 1.3.1093, which is a programming language for statistical calculations and graphics.

The comparison was made by continent, trying to select OECD countries that represented the continent well. Although China is not an OECD member, it is an

important player in the analysis in terms of its size and special situation with regard to the virus. The differences can be clearly demonstrated not only between the individual continents but also between the countries examined for the respective continents (see Table 2 in the Appendix).

Hypotheses

During our statistical analysis, we examined the validity of the following two hypotheses:

H1: The unemployment data of different countries vary by economic size and involvement in the pandemic.

Fernandes (2020) points out that there is a correlation between mortality and economic losses due to Covid-19. The main reason is that our world has become truly globalised and the pandemic is not just affecting low-income countries.

H2: The magnitude of the amount spent on fiscal rescue packages is the primary driving force behind the development of unemployment rate.

Hungary spent 2.5% of its 2019 GDP; Germany, 6%; Japan, 21%; and the USUS, 27%, on fiscal rescue packages in 2020 (IMF 2021). In the US, unemployment rose from 4.4% to 14.4% during the first wave and then returned to 5.4 (CSR 2021).

Results

Europe

We analysed four European countries: Germany, the UK, Hungary, and Italy. The development of unemployment rate in the cases of Germany and the UK traced out a similar curve after January 2020 – robustious, slower growth until November 2020 (1.2–1.3%age points higher than the level in December 2019), and a gradual abatement ensued in the magnitude of unemployment rate. The situation was quite different in Hungary. The sudden increases during the lockdown periods were followed by one-off corrections; hence, the indicator remained above 4% even after the peak was achieved in June 2020. In Italy, we witnessed a unique fall in April 2020, when the unemployment rate was 2.5–3%age points lower than in the previous and the following months. Apart from this projection, the Italian unemployment rate was relatively stable; it only leapt to higher levels in January 2021, and the increase was merely 0.5%. This is probably owing to the Italian government prohibiting companies from laying off employees.

A well-fitting stochastic time-series model was constructed for all four countries. When analysing the data of Hungary and Germany, the detectability of the trend over the estimated period is indicated by the fact that the optimal model also includes parameter drift. In both countries, the indicator became negative, which means that

we were dealing with a general downward trend over the period. This rate is higher in Hungary; that is, the Hungarian unemployment rate was reduced more strongly than in Germany. The largest difference between the observed and forecast values dates back to a similar period for both countries, December 2020 for Germany and January 2021 for Hungary. The observed level of unemployment is the same in both countries, at 4.60% (Germany) and 4.70% (Hungary). The difference between the two countries can be seen mainly in the fact that in the case of Germany the estimated unemployment rate for this period is 3.3%; and Hungary, 2.55%. This is probably related to the fact that, in industries other than hotel and hospitality, the economy restarted in both countries since the first closure. Furthermore, it should not be forgotten that labour shortages were characteristic of both countries before the Covid-19 outbreak and this phenomenon did not disappear with the outbreak (Alexander et al. 2021, Portfolio 2020).

In the UK, the difference between the forecast and the observed value was only 1.19%age points, which is a small gap between the expected and actual unemployment rates during the pandemic. This may be mainly owing to the fact that the optimal model did not include the drift parameter, as the declining trend in the unemployment rate observed in previous years came to a halt in the first quarter of 2019. In Italy, the smallest difference exists in both absolute and relative terms between the forecast and observed time-series data. This was mainly because the Italian unemployment rate was more than three times the unemployment rate measured in the other three countries. In line with the stagnant and declining trend, the observed unemployment rate for the four countries was almost higher than estimated in the first month of the forecast, which was consistently above the forecast for all four countries, except Italy.

America

Two countries from the American continent were incorporated into our analysis: the US and Chile. Although their positions and wages in the world economy are diverse, the change in the unemployment curve during the pandemic is already conspicuous prima facie. From January 2020, the level of unemployment rose steeply for four months in the US and six months in Chile, and in the following months, it started to fall with nearly half of its original intensity. The extent of the reduction had not reached the anticipated level by April 2021. In the US, the number of protrusions was higher in absolute and relative terms as well: the level of unemployment rose by 10%age points (from 3.6% to 14.8%) in three months compared to December 2019. The Chilean growth was similarly robust but minor than the North American growth: from 7.85 to 12.36% in five months.

The stochastic time-series model showed a good fit between the two countries. The US model also includes drift, as the country's unemployment rate has fallen by an average of 100%age points month-on-month. Seasonality was also observed in the

time series included in the fitted model. The unemployment rate in the country experienced the largest jump as a result of the pandemic in April 2020 (14.80%), over four times than that in December 2019 (3.60%), and much higher compared to the anticipated 3.4%.

The development of the unemployment rate in Chile is similar to that in the US, except that there has been no significant downward or increasing trend in the development of the rate for many years before the pandemic. In Chile, a few months after the Covid-19 outbreak in June 2020, unemployment peaked at "just" one-and-a-half times that of December 2019 (7.85%) and projected (7.79%).

A similarity can be found between the two countries in that the sudden rise in the unemployment rate was only able to recover somewhat and only 2%age points closer to the level estimated by the time series model for the post-pandemic period by April 2021. Accordingly, the unemployment rate, which was already above the estimated level in January 2020, remained above the projected value for both countries throughout the review period.

Asia

We analysed three totally different countries in Asia: Turkey extending to Europe, and two Far Eastern countries: Japan and China. In Japan, the unemployment rate, with moderate fluctuations, continuously abated in the 10 years preceding the pandemic. This trend ensues from two main reasons: world-class technological development and ageing population pyramid. From January 2020, we can witness a significant increase: the rate has increased nearly one-and-a-half fold; however, all this signifies a 1%age point in absolute value. In China, a predictable continuous stepdown was perceptible, reaching 3.61% in September 2019, with a continuous reduction from 4.30% in January 2010. The pandemic also had a forceful impact on the Chinese unemployment data, since it leapt from the former level to one-and-half fold (6.2%) till April 2020. In the case of Turkey, however, vigorous fluctuations can be detected in the pre-pandemic period; the level alternated between 10 and 15% and did not step out of this interval even later.

In two of the three countries, the fit of the time series model is acceptable, but the Turkish model shows a significant deviation from the observed values; therefore, the reliability of the forecast based on its model is not acceptable. This inconsistency in fitting is mainly because Turkey's unemployment rate showed a rather volatile picture during the period under review, and owing to its unpredictability, the model fitted to this time series is not predictable. This is also reflected in the fact that the estimate corresponding to 90% (Lang et al. 2020) and 80% confidence intervals, respectively, represents the widest interval of all the models.

Japan's unemployment rate began to rise steadily from January 2020 when the pandemic escalated, and lasted until October 2020, when the unemployment rate

peaked at 3.10%, which was 1.06%age points higher than the model estimate. The difference between the two levels is large in relative terms (50%) but much smaller in absolute terms. China's unemployment rate showed two major jumps (October 2019, from 3.61 to 5.10%; February 2020, from 5.30 to 6.20%) immediately after the pandemic broke out, increasing from 3.61% in September 2019 to 6.20% in April 2020 (1.5 times). By April 2021, the unemployment rate had fallen to 5.1%, which is still close to one-and-a-half times the pre-pandemic level.

Australia

In Australia the unemployment rate varied between five and six-and-a-half% during the pre-pandemic decade except for some fluctuations of a couple of tenths%age points. The 5% unemployment rate in 2019 only started to grow in April 2020, owing to the pandemic. Thereafter, the diagram of the Australian rate mostly resembles the Chilean metric, except that we can only discuss a rate of roughly half of its size.

The test statistics for the fitted stochastic model were adequate. By the end of 2019, Australia managed to reduce its unemployment rate from a high of 6.36% in 2014 to approximately 5% in early 2010, which, according to the fitted model, could have presumably remained. Although the unemployment rate had already exceeded the forecast level in January 2020, the real rise started only in April, waiting for another three months and peaked in July (7.45%). The observed unemployment rate remained above the projected value throughout the period until April 2021; although in the end, it was barely a few tenths above the pre-pandemic level of approximately 5%.

EU-27

With 27 member states since 2020, the EU has continually managed to reduce the collective unemployment rate to 6.6% (Lang et al. 2020). However, from April 2020, a continuous increment was palpable, which topped out in September at 7.8%. This tendency free from hectic swings is mainly owing to the greater weight of welfare states and the high economic development of the EU itself. Therefore, the biggest deviation between the periods directly preceding and during the pandemic was barely 1.5%.

Although the fitted model, whose test results show a good fit, does not include a drift parameter, it predicts a decline in the estimated unemployment rate, resulting in a deviation month of September 2020, with the EU figure at 7.8% instead of the projected 6.51% unemployment rate. Although the rate has been steadily declining throughout the period under review, it has remained stable at above 7%.

OECD

The evolution of the congregate unemployment rate of OECD member states bears great resemblance to the US in terms of its shape. A foreseeable stable reduction was

palpable between 2010 and 2019, during which the unemployment rate decreased from 9.9% (Scarpetta 2009) to 5.27%. Accordingly, the fitted model – the Ljung-Box statistics are insignificant so the fit of the model is acceptable – also contained the parameter of drifting, the extent of which was -0.0145%age points, that is, a 0.0145%age point decrease in the joint unemployment rate of the OECD countries would have been expected from January 2020. Conversely, the unemployment rate initially started to grow almost negligibly but indisputably, then suddenly surged to its 8.82% peak during the pandemic. Thereafter, a continuous reduction succeeded; however, it was not even successful to return to the level befitting the prediction (4.91%), but an over one-and-a-half% higher value could be measured even in April 2020.

Discussion

Similar tendencies in the evolution of unemployment rate

Having analysed the results derived from the data incorporated into our research, three groups could be distinguished based on how the trend of unemployment developed after the outbreak of the pandemic:

1. Moderate ascension and slow consolidation (Germany, the UK, Hungary, EU-27, and Japan)
2. Boisterous upswing, then slow correction (the US, Australia, China, and OECD countries)
3. One-off models (Italy, Turkey, and Israel)

This grouping verifies our first (H1) hypothesis since the two reigning powers of the global economy, the US and China, ended up in the same group. We then reviewed these groups.

Group No. 1 – Countries showing moderate ascension, slow consolidation

The first group encompasses Germany, Hungary, the UK, the entire EU, and Japan. From the similarly evolving curves, we can observe the modelled data of the UK (Figure 2).

In these countries the unemployment rate had been continuously decreasing in the decade before the pandemic. After the pandemic outbreak, the previous decrease immediately turned into a growth in all countries of the group because of the involuntary lockdown measures. The indicator continuously grew month by month and reached its peak, which was 1–1.5%age points higher than the level in December in the third (Hungary and EU-27) or fourth (Germany, the UK, Japan) quarter of 2020. Whether maximum unemployment fell into the third or fourth quarter depended on multiple factors. The first was the national appearance of Covid-19 and the speed of

governments. The Hungarian administration reacted one week after the identification of the first case on 4 March 2020 (M1 Híradó 2020). The same lasted in Germany from January 2020 (Spiegel 2020) to 22 March 2020 (i.e. seven weeks altogether), and the British reaction was at a similar speed. The first case had already spread to become a pandemic by March (British Government 2020); the government announced isolation restrictions at the end of March (Yong 2020). However, Japan's reaction differed, the first appearance of Covid-19 infection (Schnirring 2020) in mid-January 2020 was only followed by restrictions in April. These restrictions were not prohibitions but queries and demands. The spread of the pandemic was slower in Japan than in the other countries of the group, which could be owing to the famous Japanese discipline. The other reason is that the number of tests carried out for a thousand inhabitants was no more than 2.2 compared to 16 in South Korea or 43 in the US (Normile 2020); hence, there could not have been a multitude of positive test results.

Figure 2

Modelled unemployment trend in the UK (first group of countries)
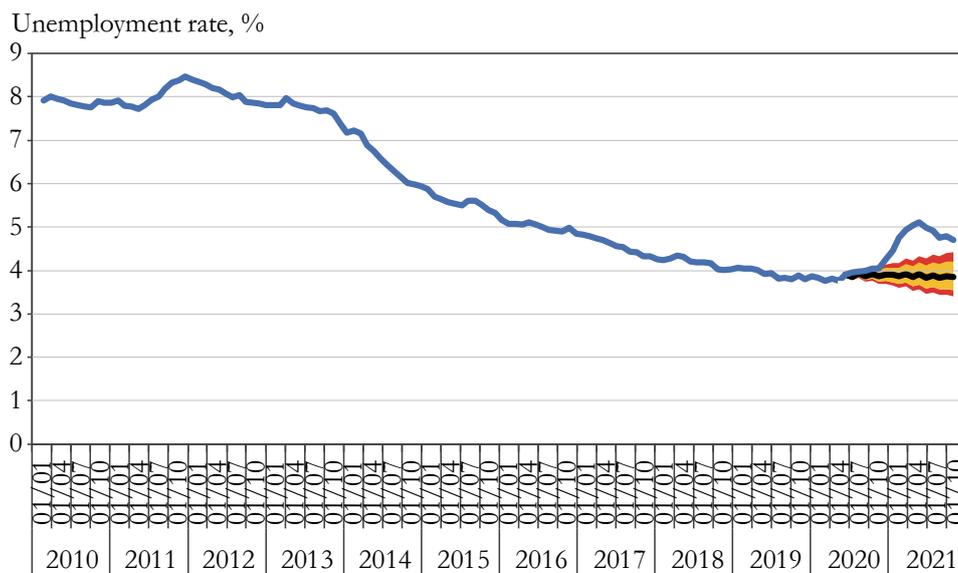
Unemployment rate, %

Note: blue: real time series unemployment data; black: forecast made with the ARIMA model based on the period 2010–2019; edit: the (black) confidence range of the estimate in the event of an unfavorable scenario (so far we accept the deviation of the actual (blue) data from the estimated (black) data); yellow: the (black) confidence range of the estimate in the event of a favorable scenario (so far we accept the deviation of the actual (blue) data from the estimated (black) data).

The rise in unemployment in these countries has not exceeded 1.5%age points anywhere, thanks to the timely economic protection decisions by governments in Europe. Public discipline plays a key role in Japan. The main reason is that the Japanese government has no legal option to decide whether to impose a state of emergency. After the peak, there was a slightly more moderate decline compared with the rise. The rate of correction was at most half a%age point; its magnitude was adjusted to the absolute size of the rate, that is, the increase was milder in the case of countries with lower unemployment rates, while in the case of higher rates, both values reached higher levels.

It is also a common feature of these countries that actual unemployment data are higher than those estimated from long-term trends using the ARIMA model. In the group, Hungary's curve during the pandemic is the flattest owing to the timely government decisions and disciplined defence. This is now complemented by a higher vaccination supply owing to the wider supply of vaccines than in Europe and the rapid increase in vaccination owing to the first vaccination campaign. Another characteristic of the Hungarian curve compared to other countries in the group is that it is the least uniform. Many changes indicate that the Hungarian economy was in a good state during the pandemic, but it was more sensitive to external shocks than others (MNB 2021). The decline following the rapid rise in the UK was because of governmental action. However, owing to the relatively belated first reaction, this cost the UK budget £ 250 billion (Costa–Machin 2020). Germany also suffered quite a bit from the first wave of delays in introducing the first short circuit. The German budget was forced to introduce a rescue package of € 156 billion in March 2020, and another € 130 billion in June. This was equivalent to nearly 6% of the annual GDP in 2019. By comparison, the Hungarian ratio is 2.5% of the annual GDP, which is a much smaller absolute amount given the country's lower economic power (IMF 2021). Japan has spent relatively little on anti-epidemic health interventions, such as not conducting mass testing and only proven positive cases. Concomitantly, the budget committed 117 trillion yen in April and May to neutralise the economic consequences of the pandemic, each representing 21% of the previous year's GDP (IMF 2021). The Japanese curve was similar to that of the German and English data, except that it was significantly lower. This is owing to a seemingly slow increase in the number of cases, one possible explanation for which is the low testing rate and the other, disciplined compliance with government requests (Le–Kim 2020).

## Group No. 2 – Countries showing boisterous upswing, then slow correction

The second group, unlike most European countries in the first group, comprises countries outside Europe: the US, Australia, Chile, China, and the whole OECD. Except for Chile, all are the world's leading economic powers. This is probably related to the fact that unemployment followed a similar trend during Covid-19 outbreak in

these countries. Out of the diagrams drawn based on the model, we highlight the example of China (see Figure 3); the other country's curves had a similar trend; the sole difference arose in the extent of the jutting part.

Figure 3

Modelled unemployment trend in China (second group of countries)
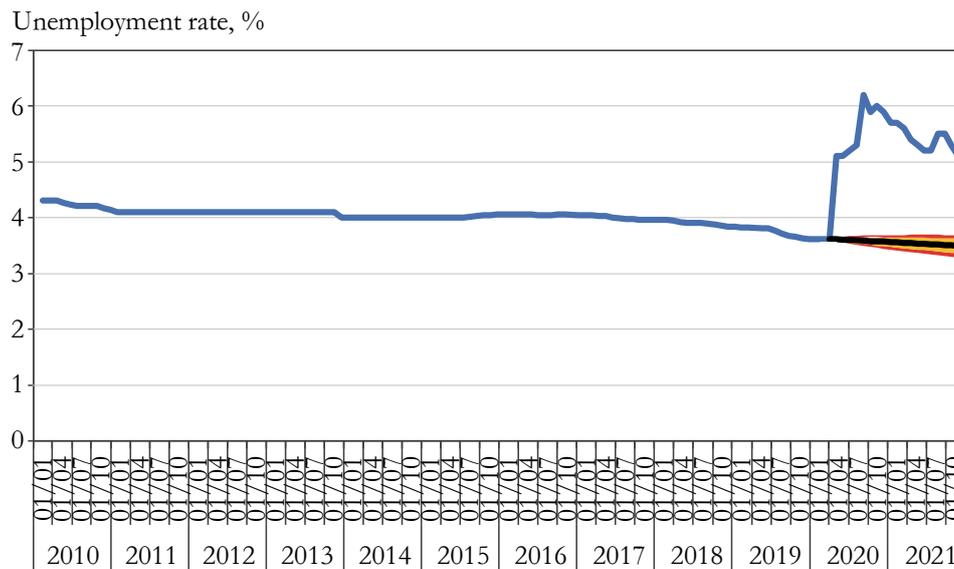
Unemployment rate, %

Note: blue: real time series unemployment data; black: forecast made with the ARIMA model based on the period 2010–2019; edit: the (black) confidence range of the estimate in the event of an unfavorable scenario (so far we accept the deviation of the actual (blue) data from the estimated (black) data); yellow: the (black) confidence range of the estimate in the event of a favorable scenario (so far we accept the deviation of the actual (blue) data from the estimated (black) data).

The US data series is characterised by a declining wave like that of the first group of countries; Australia is experiencing a 5–5 year rising and declining wave, and Chile and especially China are characterised by relatively steady performance. A common feature in the countries of the group was the change following the outbreak. The combined time series for all four countries shows a sudden increase. This rapid increase can be dated from April to June 2020. Australia reached its maximum in July 2020. This was because the archipelago announced in time and strictly adhered to the hermetic closure of its borders, successfully resisting the first wave of the pandemic. Although tourists and foreign students were left behind owing to the lockdowns, the country's economy functioned well. As a result, the UK, which prefers to operate the economy, suffered a 9.9% GDP loss in 2020, and so did Sweden, while Australia suffered only 1.1% (McDonald 2021). However, in the few months after the peak, a correction depending on the slope of the spike, roughly a quarter to half, appears in

the unemployment time series. That is, a sudden rise in unemployment was maintained for a relatively short period.

The US and Australia have reversed more than three-quarters of the rise in unemployment caused by the pandemic. This is a significant success, especially in the US, with a peak 11.4% higher than that in December 2019. Ratios like those in the US and Australia were also observed for the aggregate indicator for OECD countries: the peak was 3.55%age points above the December 2019 level, of which 2.22%age points were offset by April 2021. In the case of China and Chile, the correction was smaller, at approximately 50%, but for these two countries, the bounce was also much smaller: 2.62 and 4.56%age points, respectively.

In the US, the government has spent significant amounts (1.8% of 2019 GDP), on Short-Time Compensation (STC) programs (aid) as well as Paycheck Protection Program (PPP) and Employee Retention Tax Credit (ERTC) (Scarpetta et al. 2020). However, the biggest improvement came from the reopening of jobs in May (BLS 2021). The vaccination campaign was launched in mid-December (BBC 2020) and a quarter of the population was protected by April. This has led to significant improvements in the BLS data. From December 2020, the job opening rate rose sharply, and by May 2021, it stabilised at 6%.

The Australian labour market is quite dynamic, with many people flowing in and out of employment on a monthly basis, so the unemployment rate is fairly constant. Covid-19 ended in a five-year steady annual decline of nearly 0.2%age points in 2020. The first case was registered on 25 January 2020 (Hunt 2020). The country closed its borders in mid-March and preventive restrictions came into force at the end of the month (ABC 2020). The Reserve Bank of Australia (RBA) cut interest rates to a record 0.25%, flooded the financial system with cash, and even bought government bonds to cut interest rates. The unemployment rates in Australia and the US are similar (Reuters 2020). The authors erred in predicting a return to a long process, with only half a%age point missing from the 2.5%age point increase in the unemployment rate in the three-quarters of the year since the peak. This can be explained, among other things, by the fact that workers have migrated from the sectors affected by the pandemic to other, less limited sectors. This process affected more than 8% of all employees (AIGroup 2020).

China's unemployment rate has remained stable at approximately 5% over the past decade. However, the reason for this was methodological. According to official Chinese statistics, an unemployed person is a person who lives in a city and receives unemployment benefits (Barrett 2020). This is because all the active-age inhabitants of the villages are engaged in agriculture on state-owned land, that is, they are not unemployed, and they are even considered rural if they move to the city. Another methodological procedure is that all jobs filled are accounted for as if they were filled by Chinese citizens, even though there are millions of guest workers in the country who move from the surrounding poor countries. It is also important to examine what

characterizes the spread of the epidemic in large cities and possibly rural areas. Therefore, city policies play a prominent role in solving economic problems (Aritenang 2022). Bloomberg analysts (Liu–Zhu 2021) point out that the rapid return of unemployment to pre-pandemic levels is also statistically significant; only those employed in the industrial sector are considered in official statistics, but the 20–50% unemployment rate among young people and those working in the service sector are not. From this group, the cases of Chile and Australia are similar in that in both countries, the unemployment rate fell by April 2021 from a decade-long trend to an optimistic scenario.

Group No. 3 – Countries showing specific features (one-off models)

The three countries from the third group were placed in the same group because all three showed some kind of uniqueness in the time series, which complicated or even hindered the fitting of the corresponding time series model. In the case of Italy (see Figure 4), it was not possible to establish a model with a proper fit; however, in the case of Israel and Turkey, the model fit was not good enough. Therefore, we present Italian trends from the models of the country group.

Figure 4

Modelled unemployment trend in Italy (second group of countries)
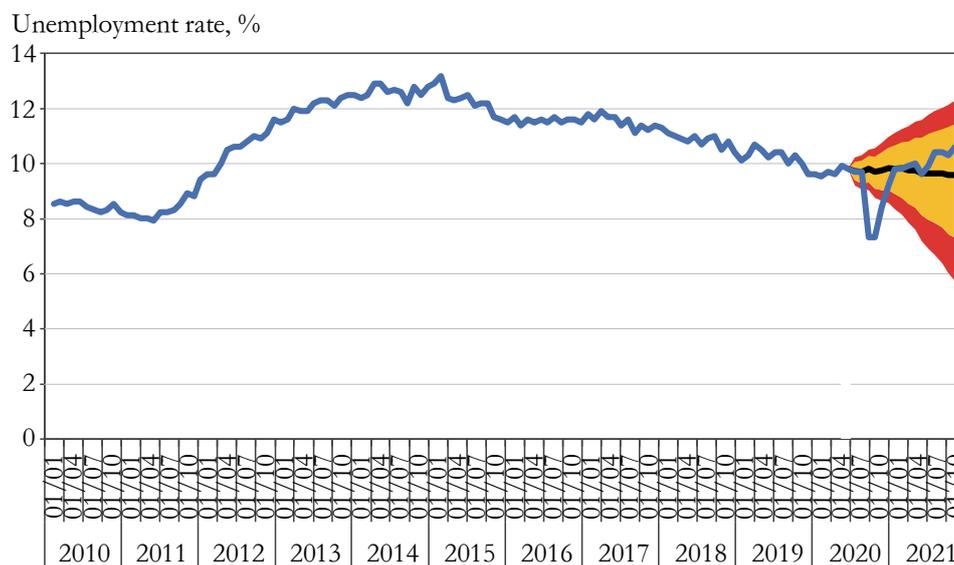
Unemployment rate, %

Note: blue: real time series unemployment data; black: forecast made with the ARIMA model based on the period 2010–2019; edit: the (black) confidence range of the estimate in the event of an unfavorable scenario (so far we accept the deviation of the actual (blue) data from the estimated (black) data); yellow: the (black) confidence range of the estimate in the event of a favorable scenario (so far we accept the deviation of the actual (blue) data from the estimated (black) data).

Among the three countries classified, Italy is the only European state, but the other two countries are categorised into the same group as the EU countries [4] partly from a geographical perspective (Turkey) and partly from the perspective of national income (Israel).

In Italy's relatively predictable unemployment curve, only small fluctuations of a few months were detected before the pandemic, which could be successfully modelled with a seasonal ARIMA model with the appropriate parameters. Surprisingly, in the first wave of the pandemic, in April 2020, the unemployment rate plunged to depths unprecedented for more than 10 years: the last time such a low one was measured was in 2007. The explanation for the rate reduction is not economy or health. Perhaps the main reason for this is that Italy was the only European country that banned companies from laying off staff or employees in the midst of the pandemic (AFP 2021b). The Italian government has mitigated the impact of Covid-19 on the labour market in the short term through work programs and restrictions on redundancies (Colussi 2020). Another reason is the methodology of the Italian Statistical Office. A person who loses his job can only be considered unemployed if he has already started looking for a job. As this was not possible during the pandemic owing to constraints, the data followed the actual changes with a lag of a few months (Spizzichino–Graziani 2021). From the summer of 2020, however, the unemployment rate in Italy also started to rise because of the lack of renewal of fixed-term contracts and the recovery in the job search wave owing to the summer opening, and soon rose again from approximately 6.7% to approximately 10%. Fortunately, this spike in the time series was not enough to ruin the fit; therefore, a model that could be used for prediction was created. Owing to the spike, the confidence intervals of 80% and 95%, respectively, were quite wide. Although the unemployment rate has risen since the escalation of the pandemic, not nearly as much as in any of the countries studied, it is important to keep in mind that unemployment in Italy was already relatively high before the pandemic: at almost eight% for almost eight years.

In the case of Israel, the pandemic did not have a negative impact on the unemployment rate in the first months of 2020, with the indicator only starting to rise somewhat like the first group of countries at the end of the first quarter (Scarpetta 2009). However, this increase persisted until the end of the period. This is a surprising trend despite the fact that this country was the world leader in terms of high vaccination coverage. In Israel, the stricter third closure began in December 2020 (Melimopoulos–Siddiqui 2020), a week after the start of the mass vaccination campaign (WHO 2021). A month later, the second doses were already given. By the summer of 2021, 58% of the population had received both vaccinations and another 6% had received the first vaccination. Nevertheless, unemployment has been rising steadily since the pandemic began. One possible reason for this was that the guest workers stayed at home, and the other was that the release of the three locks was rushed, so stricter closures became necessary later. Improperly selected workplace

protection measures can also play a role. For example, it is typical to send on unpaid leave, during which the employee cannot even take up a job elsewhere as per the legislation (Achdut 2020). Moreover, the reduction in working hours and wages has not made the world of work more attractive to young people, many of whom have opted for benefits rather than low wages. These reasons certainly contribute to the fact that the country's unemployment rate has not declined despite its high vaccination rate.

Turkey's unemployment rate has shown an upward trend since early 2012, although the time series has been plagued by waves of several years. This made it difficult to fit the model that even the doubly differentiated ARIMA model with four autoregressive and one moving average member did not show a successful fit based on Ljung-Box statistics. The unemployment rate fluctuated in the 12–15% range during the pandemic, showing neither a trend-like increase nor a decrease. The low-reliability model fitted to the unpredictable fluctuation time series produced confidence intervals with almost unusable width of 80 and 95% for the forecast period.

Conclusion

Having reviewed our results and the corresponding country groups, a few characteristics have surfaced that have contributed to the cutback in unemployment, which had grown owing to the pandemic. One of these possibilities was the introduction of governmental-political measures. If these are benefits, they only temporarily attenuate the burden of struggling workers, as they abate the penchant for work. Those measures, however, that target workplace protection may bring about a prompt (Italy) or lasting (Hungary) advancement in the development of the unemployment rate. Market-stimulating monetary measures (Australia) are similarly beneficial. However, in the event that politicians and economic experts do not make appropriate decisions, high vaccination coverage in itself does not result in amelioration (Israel).

Another key to success is that the population adhered to epidemiological restrictions in a disciplined manner. The best example of this is Japan, where despite the low vaccination rate, the number of unemployed has not been higher than in the case of the German or relatively highly vaccinated English economy. In addition, the Japanese voluntarily adopt discipline; it is a shame for them to have their names made public for violating the regulations. Similarly, Australia has successfully defended itself from short-circuit restrictions. The fact that these are island countries probably also played a role in their success, it is easier to close their borders. Experiences with border closures, albeit of a defensive nature, may also have helped Israel, where the first wave of the pandemic was barely perceptible. Unemployment data in Hungary

did not become worse than that in Germany or the UK, which is more economically developed, partly owing to disciplined compliance with restrictions and health rules.

Vaccination also played an important role in the fight against unemployment. Countries (the US, the UK, Israel, and Hungary) that first started mass vaccination campaigns have reached the edge. In the past, they were able to ease forced restrictions, which also affected the labour market. However, we have also seen the example of Israel, where a high vaccination rate alone is not enough to succeed. Some countries only accept Western vaccines, while others, such as Hungary, use Russian and Chinese vaccines. Finally, there is another "method" of reducing unemployment by methodological, that is, statistical methodology (Italy, China), but the latter method is not recommended to anyone. Therefore, based on the above results, the level of fiscal spending is only decisive in the medium and long term, while in the short term, human resources measures will help safeguard jobs and incomes. Thus, we can only partially prove the second (H2) hypothesis.

By reviewing the results, the most important general lessons can be drawn. Temporary workforce reduction programs are very effective in mitigating temporary shocks, but they lose their effectiveness if prolonged. Therefore, in the medium term, fiscal measures (such as wage subsidies) to encourage the resumption of production are important. The sharp increase in public debt caused by the Covid-19 crisis highlights the importance of efficient fiscal spending. In this respect, public investment has the greatest impact on growth. These principles allow individual states to overcome a economic crisis with maximum efficiency by adapting the aforementioned types of measures to their own capabilities. It also provides an opportunity to create a greener and more digital economy.

Our study reviewed the methods used by each country to address rising unemployment through examples of some countries. There have been successful and less successful solutions, but the correct combination of several measures usually leads to success. As we continue our study, we plan to analyse data and measures from other countries, hoping to add more information to the picture of the pandemic and unemployment.

Appendix

Table A1

Specifications of the fitted (seasonal) ARIMA models

Continent	Country	ARIMA model	λ	AR1	AR2	AR3	AR4	MA1
Europe	Germany	(2,1,2) + D	−0.326	−0.1787 (0.172)	0.7108 (0.1627)	n/a	n/a	0.2686 (0.1944)
Europe	United Kingdom	(3,1,3) (0,0,1)	−0.850	−0.8817 (0.0382)	0.8552 (0.0365)	0.957 (0.0332)	n/a	0.8693 (0.0885)
Europe	Hungary	(2,1,2) + D	0.208	−0.6861 (0.1214)	−0.8041 (0.1102)	n/a	n/a	0.4184 (0.1508)
Europe	Italy	(0,2,2) (1,0,0)	2.000	n/a	n/a	n/a	n/a	−1.2846 (0.0921)
North America	USA	(0,1,1) (1,0,1) + D	0.204	n/a	n/a	n/a	n/a	−0.4408 (0.0904)
South America	Chile	(0,1,3)	−0.899	n/a	n/a	n/a	n/a	0.2980 (0.0899)
Asia	Japan	(0,1,2) (2,0,0) + D	0.237	n/a	n/a	n/a	n/a	−0.5503 (0.0965)
Asia	China	(1,1,0) + D	2.000	0.3757 (0.0856)	n/a	n/a	n/a	n/a
Asia	Israel[a]	(1,1,0) (0,0,1) + D	0.087	−0.3619 (0.0976)	n/a	n/a	n/a	n/a
Asia	Turkey	(4,2,1)	−0.900	0.4246 (0.0962)	0.2252 (0.0954)	−0.2801 (0.0958)	0.2157 (0.0959)	−0.9787 (0.0418)
Oceania	Australia	(2,1,2)	0.723	−0.6192 (0.0928)	−0.8704 (0.1125)	n/a	n/a	0.4153 (0.1438)
Europe	EU-27 (2020)	(1,2,1)	0.646	−0.4576 (0.0939)	n/a	n/a	n/a	−0.6610 (0.0771)
World	OECD	(2,1,1) (0,0,1) + D	0.656	0.7648 (0.1222)	0.1581 (0.0948)	n/a	n/a	−0.8213 (0.0879)

(Table continues on the next page.)

(Continued.)

Continent	Country	MA2	MA3	SAR1	SAR2	SMA1	DRIFT	Ljung-Box Q (df)
Europe	United Kingdom	−0.4111 (0.1687)	n/a	n/a	n/a	n/a	−0.0037 (0.0013)	17.702 (19) p = 0.543
Europe	Hungary	−0.6172 (0.1037)	−0.7497 (0.0972)	n/a	n/a	−0.2483 (0.1006)	n/a	18.340 (17) p = 0.368
Europe	Italy	0.5708 (0.1722)	n/a	n/a	n/a	n/a	−0.0157 (0.0051)	13.314 (19) p = 0.822
Europe	USA	0.4039 (0.0914)	n/a	−0.2901 (0.0884)	n/a	n/a	n/a	25.774 (21) p = 0.215
North America	Chile	n/a	n/a	0.4770 (0.1933)	n/a	−0.8184 (0.1807)	−0.0128 (0.0008)	30.116 (20) p = 0.068
South America	Japan	0.3022 (0.0892)	−0.4146 (0.106)	n/a	n/a	n/a	n/a	19.573 (21) p = 0.548
Asia	China	−0.2789 (0.1117)	n/a	−0.3674 (0.0924)	−0.3492 (0.112)	n/a	−0.0095 (0.0004)	22.459 (19) p = 0.262
Asia	Israel[a]	n/a	n/a	n/a	n/a	n/a	−0.0233 (0.0078)	5.8224 (21) p>0.999
Asia	Turkey	n/a	n/a	n/a	n/a	n/a	−0.5203 (0.1179)	42.454 (16) p<0.001
Asia	Australia	n/a	n/a	n/a	n/a	n/a	n/a	34.604 (19) p=0.016
Oceania	United Kingdom	0.706 (0.1639)	n/a	n/a	n/a	n/a	n/a	19.753 (20) p = 0.474
Europe	EU-27 (2020)	n/a	n/a	n/a	n/a	n/a	n/a	19.365 (22) p = 0.623
World	OECD	n/a	n/a	n/a	n/a	−0.4444 (0.1214)	−0.0145 (0.0029)	15.716 (19) p = 0.676

a) Owing to missing data, the time series were fitted to the 01/2012–12/2019 period.

Table A2

Development of unemployment rate in the analysed countries/economic entities, compared to the prediction based on the fitted model

Continent	Country	12/2019	Peak month	Month of maximum deviation	Prediction	Reality	Deviation
Europe	Germany	3.30	11/2020	12/2020	3.30	4.60	1.30
Europe	United Kingdom	3.91	11/2020	11/2020	3.92	5.11	1.19
Europe	Hungary	2.90	06/2020	01/2021	2.55	4.70	2.15
Europe	Italy	9.90	04/2021	04/2021	9.67	10.70	1.03
North America	USA	3.60	04/2020	04/2020	3.40	14.80	11.40
South America	Chile	7.85	06/2020	06/2020	7.79	12.36	4.56
Asia	Japan	2.20	10/2020	10/2020	2.04	3.10	1.06
Asia	China	3.61*	02/2020	04/2020	3.58	6.20	2.62
Asia	Israel	3.62	03/2021	03/2021	3.30	5.44	2.14
Asia	Turkey	13.10	06/2020	06/2020	12.98	14.30	1.32
Oceania	Australia	5.05	07/2020	07/2020	5.07	7.45	2.37
Europe	EU-27 (2020)	6.60	08/2020	09/2020	6.51	7.80	1.29
World	OECD	5.27	04/2020	04/2020	5.21	8.82	3.61

Continent	Country	Peak vs 12/2019	Peak vs 04/2021	First above	Last above	04/2021 vs 12/2019[a]
Europe	Germany	1.30	0.20	01/2020	All along	1.00
Europe	United Kingdom	1.20	0.41	01/2020	All along	0.74
Europe	Hungary	1.80	0.40	01/2020	All along	0.50
Europe	Italy	0.80	0.00	02/2020	All along	0.90
North America	USA	11.20	8.70	01/2020	All along	2.60
South America	Chile	4.50	2.16	01/2020	All along	2.08
Asia	Japan	0.90	0.30	01/2020	All along	0.40
Asia	China	2.59	1.10	01/2020	All along	1.49
Asia	Israel	1.81	0.06	05/2020	All along	1.69
Asia	Turkey	1.20	0.40	04/2020	2020.08	1.30
Oceania	Australia	2.40	1.97	01/2020	All along	0.17
Europe	EU-27 (2020)	1.20	0.50	01/2020	All along	0.70
World	OECD	3.55	2.22	01/2020	All along	1.26

a) Data from September 2019 for China.

REFERENCES

ACHDUT, L. (2020): The labor market in the coronavirus crisis *Israel Economic Review* 18 (1): 59–79.

ANTALÓCZY, K.–BIRIZDÓ, I.–SASS, M. (2022): Local investment promotion in a Hungarian medium-sized town and the implications of the Covid pandemic *Regional Statistics* 12 (1): 27–50. https://doi.org/10.15196/RS120104

ARITENANG, A. (2022): The impact of urban characteristics on the spread of Covid-19 in 2020: The case of Java Island cities, Indonesia *Regional Statistics* 12 (3): 3–17. https://doi.org/10.15196/RS120301

ASQUITH, B. (2020): *What can we learn from the 1918 pandemic? Careful economics and policy lessons from influenza* (Policy Paper No. 2020–022; 1–30), W.E. Upjohn Institute for Employment Research. https://doi.org/10.17848/pol2020-022

BAILY, M. N.–LITAN, R. E.–JOHNSON, M. S. (2011): The origins of the financial crisis. In: KOLB, R. W.: *Lessons from the Financial Crisis* pp. 77–85., John Wiley & Sons, Inc. Hoboken, NJ. https://doi.org/10.1002/9781118266588.ch11

BARWICK, P. J.–DENG, Y.–HUANG, X.–LI, S.–LI, T. (2020): Covid-19 Pandemic and unemployment: Evidence from mobile phone data in China *SSRN Electronic Journal* https://doi.org/10.2139/ssrn.3755371

BAUER, A.–WEBER, E. (2021): Covid-19: How much unemployment was caused by the shutdown in Germany? *Applied Economics Letters* 28 (12): 1053–1058. https://doi.org/10.1080/13504851.2020.1789544

BAYRAMOV, E. (2022): Modelling travel intention in conflict-ridden destinations: the example of Turkey, 2020–2021 *Regional Statistics* 12 (2): 75–94. https://doi.org/10.15196/RS120207

BEACH, B.–CLAY, K.–SAAVEDRA, M. (2020): *The 1918 influenza pandemic and its lessons for Covid-19* (No. w27673). National Bureau of Economic Research, Cambridge, MA. https://doi.org/10.3386/w27673

BELL, D. N. F.–BLANCHFLOWER, D. G. (2020): US and UK labour markets before and during the Covid-19 crash *National Institute Economic Review* 252: R52–R69. https://doi.org/10.1017/nie.2020.14

BERKIN, C.–MILLER, C. L.–CHERNY, R. W.–GORMLY, J. L. (2015): *Making America: A history of the United States* National Geographic Learning (7th ed.) – Cengage Learning.

BESSANT, J.–WATTS, R. (2021): Covid, capital, and the future of work in Australia *AQ: Australian Quarterly* 92 (1): 20–28.

BUTTERICK, M.–CHARLWOOD, A. (2021): HRM and the Covid-19 pandemic: How can we stop making a bad situation worse? *Human Resource Management Journal* 31 (4): 847–856. https://doi.org/10.1111/1748-8583.12344

CHUNG, H.–BIRKETT, H.–FORBES, S.–SEO, H. (2021): Covid-19, flexible working, and implications for gender equality in the United Kingdom *Gender & Society* 35 (2): 218–232. https://doi.org/10.1177/08912432211001304

COLUSSI, T. (2020): *IZA Covid-19 crisis response monitoring Italy (October 2020)* (p. 8). IZA – Institute of Labor Economics, Bonn. https://covid-19.iza.org/crisis-monitor/italy/

COOPER, H.–SZRETER, S. (2021): *After the virus.* Cambridge University Press, Cambridge.

CSR (2021): *Unemployment rates during the Covid-19 pandemic* CSR (Congressional Research Service), Washington. https://crsreports.congress.gov

DIAMOND, J. (2019): *Upheaval: Turning points for nations in crisis* (Illustrated edition). Little, Brown and Company.

DIAMOND-MORTENSEN, T.– PISSARIDES, A. CH. (1994): Job creation and job destruction in the theory of unemployment *The Review of Economic Studies* 61 (3): 397–415. http://www.jstor.org/stable/2297896

FANA, M.–TORREJÓN PÉREZ, S.–FERNÁNDEZ-MACÍAS, E. (2020): Employment impact of Covid-19 crisis: From short term effects to long terms prospects *Journal of Industrial and Business Economics* 47 (3): 391–410. https://doi.org/10.1007/s40812-020-00168-5

GOSSLING, S.–SCOTT, D.–HA, M. C. (2021): Pandemics, tourism and global change: a rapid assessment of Covid-19 *Journal of Sustainable Tourism* 29 (1): 1–20. https://doi.org/10.1080/09669582.2020.1758708

GUVEN, C.–SOTIRAKOPOULOS, P.–ULKER, A. (2020): *Short-term labour market effects of Covid-19 and the associated national lockdown in Australia: Evidence from Longitudinal Labour Force Survey* (Working Paper No. 635). GLO Discussion Paper. https://www.econstor.eu/handle/10419/223013

KAPÁS, J. (2022): Has Covid-19 caused a change in the dynamics of the unemployment rate? The case of North America and continental Europe *Regional Statistics* 12 (1): 3–26. https://doi.org/10.15196/RS120107

KOSAKA, M.–HASHIMOTO, T.–OZAKI, A.–TANIMOTO, T.–KAMI, M. (2021): Delayed Covid-19 vaccine roll-out in Japan *The Lancet* 397 (10292): 2334–2335. https://doi.org/10.1016/S0140-6736(21)01220-4

LIU, S.–HEINZEL, S.–HAUCKE, M. N.–HEINZ, A. (2021): Increased psychological distress, loneliness, and unemployment in the spread of Covid-19 over 6 months in Germany *Medicina* 57 (1): 53. https://doi.org/10.3390/medicina57010053

MANGAN, D. (2020): Covid-2021): The gendered division of unpaid labor during the Covid-19 crisis: Did anything change 19 and labour law in the United Kingdom *European Labour Law Journal* 11 (3): 332–346. https://doi.org/10.1177/2031952520934583

MERAVIGLIA, C.–DUDKA, A. (? Evidence from Italy. *International Journal of Sociology* 51 (1): 64–75. https://doi.org/10.1080/00207659.2020.1832346

NORMILE, D. (2020): Japan ends its Covid-19 state of emergency *Science*. https://doi.org/10.1126/science.abd0092

RODRÍGUEZ-CABALLERO, C. V.–VERA-VALDÉS, J. E. (2020): Long-lasting economic effects of pandemics:evidence on growth and unemployment *Econometrics* 8 (3): 37. https://doi.org/10.3390/econometrics8030037

SANFELICI, M. (2020): The Italian Response to the Covid-19 Crisis: Lessons learned and future direction in social development. *The International Journal of Community and Social Development* 2 (2): 191–210. https://doi.org/10.1177/2516602620936037

SCARPETTA, S.–PEARSON, M.–HIJZEN, A.–SALVATORI, A. (2020): Job retention schemes during the Covid-19 lockdown and beyond. *OECD Policy Responses to Coronavirus (Covid-19), 2020* 1–26. https://doi.org/10.1787/0853ba1d-en

SU, C.-W.–DAI, K.–ULLAH, S.–ANDLIB, Z. (2021): Covid-19 pandemic and unemployment dynamics in European economies *Economic Research-Ekonomska Istraživanja* 1–13. https://doi.org/10.1080/1331677X.2021.1912627

THORN, A. (2020): Die Coronavirus Structural Task Force *BIOspektrum* 26 (4): 442–443. https://doi.org/10.1007/s12268-020-1408-0

INTERNET SOURCES

24.HU (2021): Rusvai: Élvezzük a maszknélküliséget, mert ősszel kezdhetjük elölről [Rusvai: We enjoy masklessness because we can start all over again in the fall, in Hungarian] *24.hu*
https://24.hu/belfold/2021/06/29/koronavirus-delta-maszk-rusvai-falus/
(downloaded: September 2021).

ABC (2020): *New social distancing rules are in place. Here's what they mean for you, your local bars and restaurants*
https://www.abc.net.au/news/2020-03-20/coronavirus-covid-19-scott-morrison-enhanced-social-distancing/12075532
(downloaded: September 2021).

ADB (2021): *Significant job losses in developing Asia in 2020, ADB data show* (India, Nepal, Philippines, Thailand). Asian Development Bank.
https://www.adb.org/news/features/significant-job-losses-developing-asia-2020-adb-data-show (downloaded: September 2021).

ADÓ ONLINE. (2020): *3,3 százalékosra csökkent a munkanélküliség* [Unemployment fell to 3.3%, in Hungarian] Adó Online.
https://ado.hu/munkaugyek/33-szazalekosra-csokkent-a-munkanelkuliseg/
(downloaded: October 2021).

AFP (2021a): Italy reports one of Europe's worst economic slumps in 2020 *The Local Italy*
https://www.thelocal.it/20210202/italy-reports-one-of-europes-worst-economic-slumps-in-2020/ (downloaded: October 2021).

AFP (2021b): 'A million more unemployed': Fears as Italy's Covid freeze on layoffs set to end. *The Local Italy*
https://www.thelocal.it/20210616/a-million-more-unemployed-fears-as-italys-covid-freeze-on-layoffs-set-to-end/ (downloaded: October 2021).

AIGROUP (2020): *Labour turnover in 2020 fact sheet.pdf* (Economics Fact Sheet, p. 2). AIGroup
https://www.aigroup.com.au/resourcecentre/economics/updates-reports/labour-turnover-in-2020 (downloaded: August 2021).

ALEXANDER, B.–PAULA, R.–DIRK, W. (2021): Skilled workers shortage among highly qualified people again above pre-Corona level (in German) *Burstedde IW-Kurzbericht* 39
https://www.iwkoeln.de/studien/alexander-burstedde-paula-risius-dirk-werner-fachkraeftemangel-bei-hochqualifizierten-wieder-ueber-vor-corona-niveau-513248.html (downloaded: August 2021).

APESO (2020): *81 million jobs lost as Covid-19 creates turmoil in Asia-Pacific labour markets* APESO
https://www.ilo.org/asia/media-centre/news/WCMS_763819/lang--
in/index.htm (downloaded: October 2021).

ASEAN (2020): *ASEAN Rapid Assessment: The Impact of Covid-19 on livelihoods across ASEAN*
(362.0959). ASEAN
https://www.rockefellerfoundation.org/wp-
content/uploads/2020/12/ASEAN-Rapid-Assessment_Final-23112020.pdf
(downloaded: September 2021).

AYHAN, K.–OHNSORGE, F. (2020): Lasting scars of the Covid-19 pandemic. In: *Global
Economic Prospects, June 2020* World Bank, Washington.
https://thedocs.worldbank.org/en/doc/112641588788257004-
0050022020/original/GlobalEconomicProspectsJune2020TopicalIssue1.pdf
(downloaded: August 2021).

BARRETT, E. (2020): The mystery of China's unemployment rate *Fortune* 3
https://fortune.com/2020/05/24/china-unemployment-rate-2/
(downloaded: September 2021).

BBC (2020): Covid-19 vaccine: First person receives Pfizer jab in UK *BBC News*
https://www.bbc.com/news/uk-55227325 (downloaded: August 2021).

BLOOMBERG (2020): *China Unemployment: Brokerage Retracts 20% Estimated Out of Work –
Bloomberg.* Bloomberg.
https://www.bloomberg.com/news/articles/2020-04-27/china-brokerage-
retracts-estimate-that-real-jobless-level-is-20 (downloaded: September 2021).

BUREAU OF LABOUR STATISTICS (BLS) (2021): *Job Openings and Labor Turnover – May 2021*
(US-21-1266; News Release, p. 20). Bureau of Labor Statistics.
https://www.bls.gov/news.release/pdf/jolts.pdf (downloaded: August 2021).

BRADLEY K. M. (2020): Confucius Is Winning the Covid-19 War *Asia Times.*
https://asiatimes.com/2020/04/confucius-is-winning-the-covid-19-war/
(downloaded: December 2021)

BRADSHER, K. (2021): Most major economies are shrinking. Not China's *New York Times.*
https://www.nytimes.com/2021/01/17/business/china-economy-gdp.html
(downloaded: December 2021)

BRITISH GOVERNMENT (2020): *Coronavirus (Covid-19) listed as a notifiable disease* GOV.UK
https://www.gov.uk/government/news/coronavirus-covid-19-listed-as-a-
notifiable-disease

BUREAU OF LABOUR STATISTICS (BLS) (2021): *Job Openings and Labor Turnover – May 2021*
(US-21-1266; News Release, p. 20). Bureau of Labor Statistics.
https://www.bls.gov/news.release/pdf/jolts.pdf (downloaded: August 2021).

CEIC (2021): *Unemployment Rate 2005–2021.* Cieicdata.com.
https://www.ceicdata.com/en/indicator/turkey/unemployment-rate
(downloaded: October 2021).

CHENG, E. (2021): China says its economy grew 2.3% in 2020, but consumer spending fell
Sun.
https://www.cnbc.com/2021/01/18/china-economy-release-of-fourth-quarter-
full-year-2020-gdp.html (downloaded: September 2021).

CLAESSENS, S. -DELL'ARICCIA , G.–IGAN, D.–LAEVEN, L. (2010): *Lessons and policy implications from the global financial crisis* (Working Paper WP/10/44; p. 41). IMF, Washington https://www.imf.org/external/pubs/ft/wp/2010/wp1044.pdf (downloaded: September 2021).

COSTA, R.–MACHIN, S. (2020): *IZA Covid-19 Crisis Response Monitoring – United Kingdom* (p. 18). IZA – Institute of Labor Economics, Bonn https://www.iza.org/wc/files/downloads/iza__crisismonitor_countryreport_uk_202011.pdf (downloaded: October 2021).

EUROPEAN COMMISSION (2021): *Jobs and economy during the coronavirus pandemic* [Text]. European Commission – European Commission https://ec.europa.eu/info/live-work-travel-eu/coronavirus-response/jobs-and-economy-during-coronavirus-pandemic_en (downloaded: October 2021).

FERNANDES, N. (2020): Economic effects of coronavirus outbreak (Covid-19) on the world economy. *SSRN Electronic Journal* https://doi.org/10.2139/ssrn.3557504 (downloaded: September 2021).

FLÓR N. (2020): *A tavaszi „Nagy Lezárás" gazdasági hatása a két legérintettebb szektorban [The economic impact of the spring "Great Closure" in the two most affected sectors, in Hungarian]* Budapest: Oeconomicus Economic Foundation. http://www.oeconomus.hu/irasok/a-nagy-lezaras-gazdasagi-hatasa-a-ket-legerintettebb-szektorokban/ (downloaded: August 2021).

GEINITZ, C. (2021): Erfolgsgeschichte in der Krise: Corona-Impfungen retten Senioren [Success story in the crisis: Corona vaccinations save seniors, in German] *FAZ.NET* https://www.faz.net/aktuell/gesellschaft/gesundheit/coronavirus/corona-impfungen-retten-senioren-todesfaelle-gehen-stark-zurueck-17218558.html (downloaded: October 2021).

GOMME, P. (2020): *Labor market and fiscal policy during and after the coronavirus* CIRANO Papers https://ideas.repec.org/p/cir/circah/2020pe-10.html (downloaded: October 2021).

HUNT, G. (2020): *First confirmed case of novel coronavirus in Australia* Australian Government Department of Health, Australian Government Department of Health https://www.health.gov.au/ministers/the-hon-greg-hunt-mp/media/first-confirmed-case-of-novel-coronavirus-in-australia (downloaded: September 2021).

IACURCI, G. (2020): *Unemployment is nearing Great Depression levels. Here's how the eras are similar – And different.* CNBC https://www.cnbc.com/2020/05/19/unemployment-today-vs-the-great-depression-how-do-the-eras-compare.html (downloaded: August 2021).

ILO (2021): *ILO Monitor: Covid-19 and the world of work. Seventh Edition* International Labour Organization https://www.ilo.org/global/topics/coronavirus/impacts-and-responses/WCMS_767028/lang--en/index.htm (downloaded: August 2021).

IMF (2021): *Policy Responses to Covid19* International Monetary Fund https://www.imf.org/en/Topics/imf-and-covid19/Policy-Responses-to-Covid-19 (downloaded: September 2021).

INSEE (2021): *Definition – Unemployed person according to ILO* Insee
https://www.insee.fr/en/metadonnees/definition/c1129
(downloaded: October 2021).

ISDA (2021): *The role of financial markets and institutions in supporting the global economy during the Covid-19 pandemic* International Swaps and Derivatives Association
https://www.isda.org/2021/05/24/the-role-of-financial-markets-and-institutions-in-supporting-the-global-economy-during-the-covid-19-pandemic/
(downloaded: August 2021).

ITSTAT (2020): *Occupati e disoccupati Settembre_2020* Italian Statistical Office, Rome
https://www.istat.it/it/files//2020/10/CS_Occupati-e-disoccupati_SETTEMBRE_2020.pdf (downloaded: August 2021).

JACKSON, J. K–WEISS, M. A.–SCHWARZENBERG, A. B.–NELSON, R. M.–SUTTER, K. M.–SUTHERLAND, M. D. (2021): *Global economic effects of Covid-19* (No. R46270). Congressional Research Service, Washington
https://crsreports.congress.gov/product/pdf/R/R46270
(downloaded: September 2021).

KATI, Y. (2021): *TURKSTAT Corporate*
https://data.tuik.gov.tr/Bulten/Index?p=Labour-Force-Statistics-November-2020-37480&dil=2 (downloaded: August 2021).

KING, B. (2021): Unemployment rate: How many people are out of work? *BBC News* 2.

KŐMŰVES, A.–OVERSTRATEN, B. VAN–BINNIE, I. (2020, December 27): 'Window of hope': Europe begins to launch Covid-19 vaccinations *Reuters*
https://www.reuters.com/article/health-coronavirus-europe-vaccines-idUSKBN29102Y (downloaded: September 2021).

KURAS, P. (2020): Germany is cautiously starting to ease its lockdown – but it's harder than it looks *The Guardian*
http://www.theguardian.com/commentisfree/2020/apr/18/germany-ease-lockdown-harder (downloaded: October 2021).

LAI, H.–KHAN, Y. A.–THALJAOUI, A.–CHAMMAM, W.–ABBAS, S. Z. (2021): Covid-19 pandemic and unemployment rate: A hybrid unemployment rate prediction approach for developed and developing countries of Asia *Soft Computing*
https://doi.org/10.1007/s00500-021-05871-6 (downloaded: October 2021).

LANG, V.–GENEV, B.–HENRION, T. (2020): *Euro area unemployment at 7.4%* (No. 35/2020). Eurostat, Luxemburg
https://ec.europa.eu/eurostat/documents/portlet_file_entry/2995521/3-03032020-BP-EN.pdf/af09316f-78d0-037c-b27b-fa7844dc2c96 (downloaded: August 2021).

LE, T.–KIM, H. (2020): How Culture Explains Covid *Tokyo Review*
https://www.tokyoreview.net/2020/11/covid-culture-in-the-us-and-japan/
(downloaded: January 2022).

LIU, J.–ZHU, L. (2021): China's falling unemployment masks a lack of jobs for the young *Bloomberg.Com*
https://www.bloomberg.com/news/articles/2021-06-20/china-s-falling-unemployment-masks-a-lack-of-jobs-for-the-young (downloaded: October 2021).

LUND, S.–ELLINGRUD, K.–HANCOCK, B.–MANYIKA, J. (2020): *Covid-19 and jobs: Monitoring the US impact on people and places* McKinsey Global Institut https://www.mckinsey.com/~/media/McKinsey/Industries/Public%20and%20Social%20Sector/Our%20Insights/Covid%2019%20and%20jobs%20Monitoring%20the%20US%20impact%20on%20people%20and%20places/Covid-19-and-jobs-Monitoring-the-US-impact-on-people-and-places.pdf (downloaded: September 2021).

M1 HÍRADÓ (2020, March 12): *Veszélyhelyzetet hirdetett a kormány az ország egész területére [The government has declared a state of emergency throughout the country, in Hungarian]* https://web.archive.org/web/20200312185817/https://hirado.hu/kozelet/cikk/2020/03/11/elo-sajtotajekoztatot-tart-az-operativ-torzs (downloaded: January 2022).

MÁRTONFFY, A. (2021): Koronavírus: Japán másképp védekezik, mint Európa [Coronavirus: Japan defends itself differently than Europe, in Hungarian] *Magyar Nemzet* https://magyarnemzet.hu/kulfold/koronavirus-japan-maskepp-vedekezik-mint-europa-9193988/ (downloaded: September 2021).

MCDONALD, J. (2021): *How Australia's Covid policy backfired* https://thediplomat.com/2021/08/how-australias-covid-policy-backfired/ (downloaded: October 2021).

MELIMOPOULOS, E.–SIDDIQUI, U. (2020): *Covid: Israel enters third lockdown amid vaccination drive* [Aljazeera] https://www.aljazeera.com/news/2020/12/27/japans-halts-foreign-arrivals-over-new-covid-strain-live-news (downloaded: January 2022).

MNB – HUNGARIAN NATIONAL BANK (2021): *Macroeconomic and financial market developments* (p. 20) [Background material] https://www.mnb.hu/letoltes/hatteranyag-a-monetaris-tanacs-2021-majus-25-i-ulesenek-roviditett-jegyzokonyvehez-en.pdf (downloaded: January 2022).

MORRIS, C.–WEIDENKAFF, F. (2020): *Tackling the Covid-19 youth employment crisis in Asia and the Pacific* Asian Development Bank https://www.adb.org/publications/covid-19-youth-employment-crisis-asia-pacific (downloaded: September 2021).

MORRISON, W. M. (2019): *China's economic rise: History, trends, challenges, and implications for the United States* Congressional Research Service, Washington https://www.everycrsreport.com/files/20190625_RL33534_088c5467dd11365dd4ab5f72133db289fa10030f.pdf (downloaded: October 2021).

MORTON, B.–FAULKNER, D. (2021): Indian variant: Second jabs could be brought forward to tackle rise *BBC News* https://www.bbc.com/news/uk-57109660 (downloaded: January 2022).

HIRADO.HU (2020): Szijjártó: Hosszú távra kell berendezkedni a járvány elleni védekezésben [You'll have to settle for long-term protection against the epidemic, in Hungarian] *hirado.hu* https://hirado.hu/belfold/kozelet/cikk/2020/03/28/szijjarto-hosszu-tavra-kell-berendezkedni-a-jarvany-elleni-vedekezesben/ (downloaded: September 2021).

OLTERMANN, P. (2021): Germany to ease Covid travel restrictions on UK travellers from Wednesday *The Guardian* http://www.theguardian.com/world/2021/jul/06/germany-and-uk-to-ease-covid-travel-restrictions-from-wednesday (downloaded: September 2021).

PARTINGTON, R. (2021): UK unemployment falls for first time in Covid-19 pandemic *The Guardian* http://www.theguardian.com/business/2021/mar/23/uk-unemployment-falls-covid-19-jobless-rate (downloaded: January 2022).

PORTFOLIO (2020): *Another national labor shortage is imminent (in Hungarian)* Portfolio.hu https://www.portfolio.hu/gazdasag/20210629/kuszobon-az-ujabb-orszagos-munkaerohiany-490178 (downloaded: October 2021).

REUTERS (2020): Australia unemployment rate at 5-year high *The Hindu* 3 https://www.thehindu.com/news/international/australia-unemployment-rate-at-5-year-high/article31579443.ece (downloaded: September 2021).

RUFFINO, L. (2021): Nuovi dati Istat sulla mortalità [Tweet] *@Ruffino_Lorenzo* https://twitter.com/Ruffino_Lorenzo/status/1367798253366910977 (downloaded: September 2021).

SCARPETTA, S. (2009): *Unemployment in OECD countries to approach 10% in 2010, says OECD* https://www.oecd.org/employment/unemploymentinoecdcountriestoapproach10in2010saysoecd.htm (downloaded: September 2021).

SCHNIRRING, L. (2020): *Japan has 1st novel coronavirus case; China reports another death* CIDRAP https://www.cidrap.umn.edu/news-perspective/2020/01/japan-has-1st-novel-coronavirus-case-china-reports-another-death (downloaded: October 2021).

SPIEGEL (2020): Coronavirus: Bayerische Behörden bestätigen ersten Fall in Deutschland [Coronavirus: Bavarian authorities confirm first case in Germany, in German] *Der Spiegel* https://www.spiegel.de/wissenschaft/medizin/corona-virus-erster-fall-in-deutschland-bestaetigt-a-19843b8d-8694-451f-baf7-0189d3356f99 (downloaded: January 2022).

SPIZZICHINO, A.–GRAZIANI, C. (2021): *Employment and unemployment* (No. 202012; p. 11). Italian Statistical Office, Rome https://www.istat.it/it/files//2021/02/Employment-and-unemployment_202012.pdf (downloaded: August 2021).

STRAUSS-KAHN, M.-O. (2020): *Can we compare the Covid-19 and 2008 crises?* Atlantic Council https://www.atlanticcouncil.org/blogs/new-atlanticist/can-we-compare-the-covid-19-and-2008-crises/ (downloaded: September 2021).

SUBBARAMAN, R.–VARMA, S. (2020, July 1): Asia has an unemployment crisis waiting to happen *Nikkei-Asia* 4. (downloaded: September 2021).

TEAGUE, G. M. (2021): *Turkey's labor market policy in 2020: Success or failure?* Socialprotection.org https://socialprotection.org/discover/blog/turkey%E2%80%99s-labor-market-policy-2020-success-or-failure (downloaded: January 2022).

TETLOW, G.–POPE, T.–DALTON, G. (2020): *Coronavirus and unemployment* (IfG Insight, p. 30). Institute for Government https://www.instituteforgovernment.org.uk/sites/default/files/publications/coronavirus-unemployment-five-nation-comparison.pdf (downloaded: October 2021).

TEXTOR, C. (2021): China's share of global gross domestic product (GDP) 2010–2026. https://www.statista.com/statistics/270439/chinas-share-of-global-gross-domestic-product-gdp/ (downloaded: December, 2021)

TURAK, N. (2021): *Turkey goes into its first full lockdown as a third Covid wave surges* CNBC https://www.cnbc.com/2021/04/29/turkey-goes-into-first-full-lockdown-as-third-wave-covid-cases-surge.html

USBL (2021): *How the government measures unemployment* https://www.bls.gov/cps/cps_htgm.htm# (downloaded: October 2021).

WHO (2021): *Israel Covid vaccination*. Our World in Data https://ourworldindata.org/covid-vaccinations?country=ISR (downloaded: January 2022).

WORLD BANK (2020): *WDI – The world by income and region* https://datatopics.worldbank.org/world-development-indicators/the-world-by-income-and-region.html (downloaded: September 2021).

YONG, E. (2020): *The U.K.'s Coronavirus 'Herd Immunity' Debacle* The Atlantic https://www.theatlantic.com/health/archive/2020/03/coronavirus-pandemic-herd-immunity-uk-boris-johnson/608065/ (downloaded: September 2021).

POPE, T.–HOURSTON, P. (2022): *Coronavirus: how countries supported wages during the pandemic* https://www.instituteforgovernment.org.uk/explainers/coronavirus-public-support-wages (downloaded: April 2022).

DATABASES/WEBSITES

[1] AUSTRALIAN BUREAU OF STATISTICS (2022): *Labour Force, Australia, July 2022* https://www.abs.gov.au/statistics/labour/employment-and-unemployment/labour-force-australia/latest-release#:~:text=In%20seasonally%20adjusted%20terms%2C%20in,decreased%20by%2020%2C200%20to%20473%2C600 (downloaded: August 2022).

[2] ORGANIZATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT (OECD) (2021): OECD Data https://data.oecd.org/ (downloaded: April 2021)

[3] TRAIDING ECONOMICS: https://tradingeconomics.com (downloaded: September 2021).

[4] WORLD BANK (2021): *GDP growth (annual %) – China*. Data.Worldbank.Org https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?locations=CN (downloaded: September 2021).