

Asian answers to COVID-19-induced unemployment through the example of three countries

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Abstract: Asia is one of the most diverse regions on earth. Some countries are characterized by poverty and the daily struggle for livelihood, while others are among the strongest and most dynamically growing parts of world economy. COVID-19 caused a real global economic downturn, which led to a sudden rise in unemployment and income-induced insecurity. We have focused our research on three countries. One of them is Japan: it is one of the most stable economies in the region and has long been one of the model states for the modern economy. The other is South Korea: one of the fastest growing economies in Asia, with extensive international connections. The third country is Australia, which belongs to the Anglo-Saxon culture. Our research goal was to examine the evolution of unemployment in the decade before the pandemic, and the impact of short-term measures introduced because of the epidemic. For our study, we chose the ARIMA method, which is suitable for the analysis of long time series based on the OECD database and for estimating the future development of the data. Our results show that because of the epidemic, unemployment increased in all the three countries studied, but due to the typical response strategy of each country, the subsequent development of the data was no longer the same. In our study, we examine the labour market impact of each protection strategy and draw attention to the most effective ways of protection against a subsequent pandemic.

Keywords: unemployment; Asia-Pacific region; economic crisis; ARIMA; forecast; COVID-19

1. Introduction

At the heart of our study, we examine the three major economies in the Asia-Pacific region, China, Japan, and South Korea. Our research question is whether similarities or differences dominate within a region. The topicality of the study is given by the spill-over effects of the global economic downturn due to COVID-19. Although some countries (China) say it has recovered to pre-pandemic levels, others (Thailand) are still struggling with the aftermath of the virus. COVID-19 threatens the workforce, i.e., human resources, and initially only lockdown measures helped to overcome the infection. Therefore, many workplaces had to be closed with working hours and wages cut. We examine the evolution of the unemployment rate in the three countries during the pandemic and compare it with an estimate based on the trend of the previous ten years. This is how we show the impact of COVID-19 on the labour market.

2. Literature review

The World Health Organization (WHO) released a report in September 2019 (WHO, 2019) in which analysts of the organization drew attention to the possibility of an imminent global epidemic. If this report had received more publicity, many things might have turned out differently. But that is not what happened. In the financial sphere of the world economy, which has been on a growth trajectory for decades, no one is interested in maintaining continued

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growth. The willingness to pay attention to risks has decreased, and the hunger for profit has increased, which has slowly evoked the pre-crisis conditions of 2008 (Strauss-Kahn, 2020). In addition, despite global growth, many countries were in recession, which means that these countries were not able to deal with unexpected crises. In this situation, the COVID-19 epidemic broke out in China in December 2019.

There were epidemics even before it. But they were either severe but localized like Ebola or not so global in effect like bird flu. The coronavirus was the first virulent and global epidemic to have a global economic impact today. It was therefore particularly painful that the pandemic became a “black swan” event (Taleb, 2008) with the WHO alerting the world in advance. The main means of controlling the epidemic were to reduce the number of interpersonal contacts and short-term restrictions before vaccination was introduced. These measures had a significant negative impact in all countries concerned, which was also significant at the global level (Ku et al., 2020). Production and service companies closed, and unemployment rose. The increase in global unemployment rate was 17 percent at the end of 2019 and was around 12 percent even in the last quarter of 2020 (ILO, 2021). European data showed a decrease of 14% over the same period (Eurostat, 2020). According to ILO (2021), the decline in 2020 was also 7.3 percent in the study region, equivalent to the loss of 125 million full jobs. The picture of the labour market was quite diverse (Cortes & Forsythe, 2020), but hospitality, the hotel industry, and entertainment were sensitive to the lockdowns (Coldiretti, 2020). Nevertheless, China, one of the largest economies in the Asia-Pacific region, was the only one in the world to produce nearly 2 percent economic growth in 2020 despite the hard effects of COVID-19 (Zhang, 2021). In the end, China was not included in the list of countries studied. The reason for this is mainly methodological: Chinese unemployment statistics are strongly skewed. This is because official data include only adult urban unemployment; youth and rural unemployment of much higher levels are not included (Liu & Zhu, 2021).

The cause of economic uncertainty in 2019 was geopolitical tensions and trade wars, which were further exacerbated by the pandemic in 2020 (Baker et al., 2020). Not only has the economy been affected by the crisis, but household expectations also fell: the consumer confidence index hit a low in April 2020 (Trading Economics, 2021).

Although short-term restrictions were the basis for defence everywhere, practice varied considerably from country to country. Of the countries studied, Korea opted for mass testing (Benke, 2020). With this, the main goal was the early screening, isolation, and treatment of those infected. The measures have proved effective: the country has survived the first wave of the epidemic almost without a trace. Unfortunately, due to the subsequent significant decline in public discipline, the next wave of epidemics has already had a significant impact on South Korea (Gallo, 2020) and forced the government to impose permanent restrictions (Associated Press, 2021).

South Koreans performed a plethora of tests (roughly twenty thousand a day), sought contacts, and began early treatments. This was the 3T (test, trace, treat) protocol (Yilmaz & Aydin, 2020). The aim was to deal with identified cases as soon as possible. The success of the method was demonstrated by the fact that full recovery was achieved in 93 percent of positive cases. In addition, detailed information on all positive cases of the coronavirus was reported immediately. As a result, the Asian country had a high rate of infection, but the mortality rate was extremely low. Twenty thousand tests a day were central to early detection, minimizing the spread of the virus and allowing rapid treatment for those who produced a positive test. The frequency of positive tests was below one (compared to over six in Italy, for example). Together with testing, informing the population and providing high-quality health care have helped control the epidemic (Benke, 2020). In South Korea a different model was used to deal with the epidemic as compared to the other country studied, Japan. In Korea the initial presidential leadership was later replaced by a model based on co-operation between bureaucracy and civil society (Moon et al., 2021). The success of the Korean way of protection was greatly facilitated by the fact that the country was able to put into practice the experience gained in the fray against the two previous coronavirus epidemics, the avian influenza 2003 (SARS) and the Middle East respiratory syndrome (MERS) of 2015 (Comfort et al., 2020). The government prepared a crisis plan, the stages of which were colour-coded (blue = not infected in the country, yellow = infected in the country, orange = regional spread, red = nationwide spread), and developed appropriate measures for each stage (Dyer, 2021). Close co-operation based on information sharing developed between the government and urban-

provincial governments (Moon, 2020). This collaboration has also contributed to the success of open data applications such as 'Coronamap' and 'Maskfinder' (Lee et al., 2020). It was also due to the free flow of information that physicians had access to patient travel data as well as effective quarantine measures (Kim et al., 2020). Since the epidemic became nationwide, the anti-COVID-19 summit has met daily, with representatives of ministries and big cities discussing decisions to be made (Dyer, 2021), with the involvement of independent experts. From an economic point of view, the biggest result of the measures in the first wave was that the Korean economy did not have to be shut down for a single day, and everyday life continued under normal conditions (Gallo, 2020). In August, however, the situation changed. Due to violations of preventive rules, a religious community in Seoul was responsible for the infection of 312 people. Due to another wave of the illness, there were several major anti-government protests in Seoul (Gallo, 2020). Authorities tightened lockdown rules to prevent the pandemic: stay-at-home rules were introduced, nightclubs as well as several high-traffic workplaces were closed, gates to sporting events were closed for the public, and the maximum number of people allowed in one space was limited. All these measures also contributed to the rise in unemployment. Authorities eased the tight closure in September due to favourable developments in epidemiological data (Associated Press, 2021), followed by further facilitations in October (Shin, 2020). From November, the number of cases rose again, and by December, Korea was hit by the third wave of the epidemic. The drastic increase in the number of cases was due to Christmas family reunions, hospital and nursing home visits, and New Year's Eve events were virtually banned. In addition, a new variant of the virus appeared in Korea by the end of the year (Associated Press, 2020; Rourke, 2020). Vaccinations were started by Korea at the end of February 2021, and by the end of the study period, April 2021, 0.4 percent of the total population had received the dose required for full immunization, and 6 percent had the first vaccine (Mathieu et al., 2021).

Japan (CEIC, 2021; Lai et al., 2021; Martinffy, 2021; Morris & Weidenkaff, 2020) is one of the countries most affected by the epidemic. The country has opted for a special defence against the pandemic. This is due to the lack of constitutional authority (Saito, 2020). The first case was reported by the authorities on 16 January 2020 (Schnirring, 2020). The measures introduced from April 2020 were requests that most of the population complied with in a disciplined manner. The person who complied with the rules became eligible for state aid, and the name of the person who violated such rules was made public. The political leadership (parliament) gradually took control of the bureaucracy and used civilian capacities. At the same time, there is no top health body in Japan that has the autonomy to decide on necessary measures. The bodies set up by the Prime Minister also act only as advisory bodies. The relatively narrow room for manoeuvre of the parliamentary system and the government resulted in different responses than in the case of South Korea as will be described later. Non-governmental organizations, e.g., the so-called *jishuku keisatsu* (self-restraint police) were given more importance. This organization, made up of local citizens, monitored and enforced, if necessary, compliance with the proposed preventive closure measures (closing of shops, wearing masks) at the local (city, municipal) level. Another reason for the initial slow spread is that the number of tests performed per thousand inhabitants was only 2.2 compared with 16 in South Korea or 43 in the United States (Normile, 2020). The main reason for this is the austerity-based health policy: only those who had symptoms suggestive of COVID-19 were tested (Moon et al., 2021). Japan started its vaccination program as one of the last of economically developed states, and vaccination coverage is still low (Kosaka et al., 2021). Despite the cautious approach, the Japanese data did not get significantly worse than the statistics of South Korea, which followed a completely different path. As a result of favourable epidemiological indicators, the government lifted restrictions in mid-May 2020, but barely two months later, the lockdown had to be re-introduced due to new infections. The essence of these new measures is the 3C principle developed by the World Health Organization (WHO): avoid closed spaces (with poor ventilation), crowded places (with many people nearby) and close-contact settings (such as close-range conversations) (WHO, 2020). The cyclicity of case numbers and responses remained for the rest of the year, so New Year's Eve was activities were limited. In Japan, vaccinations began as early as February 2021, but due to its slow pace, total vaccination was only 0.8 percent by the end of April and only 2 percent of the population received full immunization (Mathieu et al., 2021).

The Anglo-Saxon countries, including Australia, were hit hard by COVID-19. Australia gradually introduced the shutdown. The exact timing of the closures and the range of people

involved varied from state to state, but the national cabinet ordered the first business closure on 22 March, including bars, churches, and schools. Retail and catering stores closed on 26 March as well as travel and exit restrictions began on 29 March (Grattan, 2020). The initially rapidly growing number of cases had already peaked on 22 March so closures were a bit late. The second wave started in Victoria in June 2020 and hit that state the hardest. It also ended here on 27 October. The nationwide vaccination program was launched in Sydney on 21 February 2021 with the first doses of Pfizer COVID-19, but neither the target nor the rate of vaccination was considered appropriate by critical analysts (Butt, 2020).

The epidemic thus had a significant negative impact on the Australian labour market (Boyton, 2020). Unemployment was 5.1% in July 2019, peaked at 7.5% at the time of the pandemic in July 2020, and fell to 6.6% by the end of 2020 (Duke, 2021), which also led to a reduction in job-search benefits. Data released in April for the period from February to March 2021 show that unemployment fell further to 5.8% (McHugh, 2021), 0.4 points higher than at the start of the epidemic.

The effects of the Australian government budget package are described in the work of Tetlow et al. (2020). In Australia, the proportion of the workforce receiving unemployment benefits rose by six percentage points to 12%, with a further 21% of the workforce working for government-subsidized businesses as turnover had fallen significantly. On 22 March, the day after the first round of businesses closed, the government announced an increase in the standard "JobSeeker" unemployment benefits of A\$550 every two weeks. This means that a claimant without dependents could claim up to A\$1,116 every two weeks (approximately £290 per week). The new "JobKeeper" payroll scheme was announced on 30 March, the day after the full close: it is A\$750 a week for businesses for every employee retained, which is to be spent entirely on employees.

In view of the above findings, we have formulated the research hypothesis that the labour market impact of the pandemic and recovery are similar in countries with similar economic strengths.

3. Methodology

We examined how the pandemic affected the unemployment rates of the countries studied. Data were obtained from the OECD database available at <https://data.oecd.org>. If the time series examined was incomplete, it was replaced by information available on the website of Trading Economics (<https://tradingeconomics.com>). Because we often had to work with time series showing significant fluctuations and as our goal was to make predictions, we did not find the deterministic method using linear trends to be sufficiently sensitive to achieve our research goal. Therefore, we opted for stochastic analysis and chose the autoregressive integrated moving average (ARIMA) method, which also models random effects (Hipel, 1985; Jensen, 1990; Nelson, 1998). The starting point for this is that the time series used are considered stationary. These time series can be modelled by autoregressive (AR) processes, assuming that, in addition to the immediate past, random error also plays a role in the evolution of present values of .data These models are classified according to the number of constants (p) in them (p=1–first order model, p=2–second order model...). Randoms are modelled using a moving average (MA), and their order (q) is also determined by the number of members. By applying the two models together, the role of the values and random factors of the previous periods can also be modelled. If necessary, stationary transformations (logarithmization, differentiation) can be used to filter out variability in the appropriate degree (d). Thus, with the help of autoregressivity, we can estimate how a given member of the time series depends on the previous member(s) in front of it, and with moving averages we were able to model the dependence of the same member on random factors in the previous period(s). Due to the difference creation by integrating the time series, continuous changes do not appear in the model.

Detection of the effect of the pandemic was performed in several steps. In the first step, we determined the most optimal ARIMA (or, if necessary, seasonal ARIMA) model based on the 'Akaike criterion' (AIC), which showed the most accurate fit with the monthly unemployment data series from January 2010 to December 2019. Finding the optimal model also involved the necessary 'Box-Cox transformation'. If a trend-like change could be detected during the study period, this was also included in the model (drift). Because our primary goal was

prediction, we used the 'Ljung-Box statistics', which examines global fit to evaluate fitted models (Table 1). The projected monthly unemployment data were compared with the observed values so that the differences between the data estimated based on the 10-year trend and the actual data due to the pandemic be detectable between January 2020 and April 2021 (Table 2). All calculations were performed using 'RStudio 1.3.1093'.

4. Results

The Korean curve is characterized by a stagnant trend before the epidemic. The many up-and-down changes indicate that while the Korean economy was hit severely by the pandemic, it was more vulnerable to external shocks than the other countries studied. Korea's unemployment rate was more hectic than that of Japan or the growing Australian one, but its rate (3–4.5%) was like that of the Japanese one at the outbreak. Australian data started at around 5%. Higher variability results in a larger confidence interval of forecast (Figure 1). The more intense movement of the indicator also shows that the Korean economy is more dependent on external shocks than Japan or China. The sudden increase after the epidemic outbreak was soon offset by the low mortality rate (3T) attributable to the high testing rate, mass contact research, and the immediate treatment of the infected. The more intense movement of the indicator also indicates that the Korean economy is more exposed on external shocks than Japan or Australia.

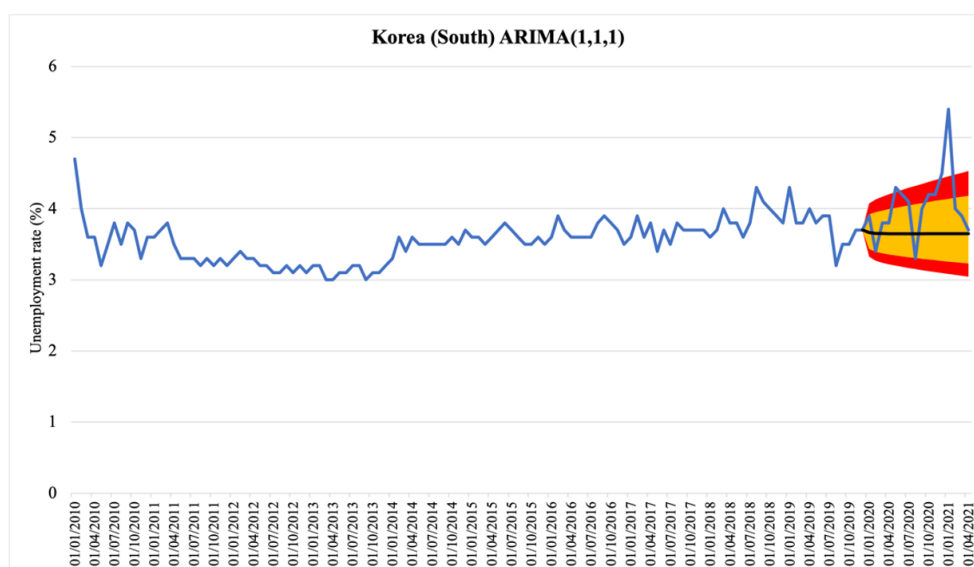


Figure 1. ARIMA – Korea (South). Source: own work

The impact of the first wave on the labour market had peaked in four months, by the beginning of the summer, with an unemployment rate of 4.2 percent. This was an increase of 0.8 percentage points from 3.4 percent in early February, which is very close to our most pessimistic trend-based estimate. Growth is higher than Japan's 0.5-percentage-point growth over the same period, while Australia survived the first wave with an unchanged unemployment rate of 5.01 percent. This suggests that Korea has successfully picked up the fight against the first wave of the pandemic. Although this increase was quickly offset, it rose to 5.4 percent by the end of 2020, the highest in the country during the period under review.

This is probably explained by the fact that mass testing and treatment depleted Korean health care reserves, making protection against new waves of the epidemic less successful. One reason for the increase was the already mentioned August epidemic (Gallo, 2020), which was further exacerbated by Christmas relatives and the emergence of a new virus variant by the end of the year (Rourke, 2020).

Table 1. ARIMA specifications. *Source: own work*

	KOREA	JAPAN	AUSTRALIA
ARIMA model	(1,1,1)	(0,1,2) (2,0,0) +D	(2,1,2)
lambda	-0.899	0.237	0.724
AR1	NA	NA	-0.6192 (0.0928)
AR2	NA	NA	-0.8704 (0.1125)
AR3	NA	NA	NA
AR4	NA	NA	NA
MA1	0.2980 (0.0899)	-0.5503 (0.0965)	0.4153 (0.1438)
MA2	0.3022 (0.0892)	-0.2789 (0.1117)	0.706 (0.1639)
MA3	-0.4146 (0.106)	NA	NA
SAR1	NA	-0.3674 (0.0924)	NA
SAR2	NA	-0.3492 (0.112)	NA
SMA1	NA	NA	NA
DRIFT	NA	-0.0095 (0.0004)	NA
Ljung-Box Q (df)	19.573 (21) p=0.548	22.459 (19) p=0.262	19.753 (20) p=0.474

Table 2. Unemployment rate in examined countries and forecasts from model. *Source: own work*

	KOREA	JAPAN	AUSTRALIA
12.2019	3.70	2.20	5.05
Peak	2021.01	2020.10	2020.07
Maximal difference	2021.01	2020.10	2020.07
Forecast	3.65	2.04	5.07
Real	5.40	3.10	7.45
Difference	1.75	1.06	2.38
Peak vs. 12.2019	1.70	0.90	2.40
Peak vs. 04.2021	1.75	0.30	1.97
Above first	2020.01	2020.01	2020.04
Above last	2021.04	All	2021.03
04.2021 vs. 12.2019	0.00	0.40	0.03

In Japan (Figure 2), the unemployment rate had been steadily declining for years before the epidemic. The coronavirus put an end to this decline. The unemployment rate began to rise immediately due to short-term lockdown proposals after the outbreak. The indicator grew steadily month-on-month, peaking in the fourth quarter of 2020, when the unemployment rate peaked at 3.10%: 1.06 percentage points higher than the model estimate, which was 1.06 percentage points higher than in December 2019. Six million people were inactive in the labour market in that month (Subbaraman & Varma, 2020). The gap between the two levels is relatively large (50%) but much smaller in absolute terms: up to half a percentage point.

The reason for low unemployment rates is the seemingly slow increase in the number of cases, one possible explanation to which is the low testing rate and the other is the disciplined compliance with government requests. Among the countries surveyed, Korea's curve during the pandemic is the flattest, but Japan's unemployment growth has not exceeded 1.5 percentage points, which is largely due to timely government protection decisions by governments.

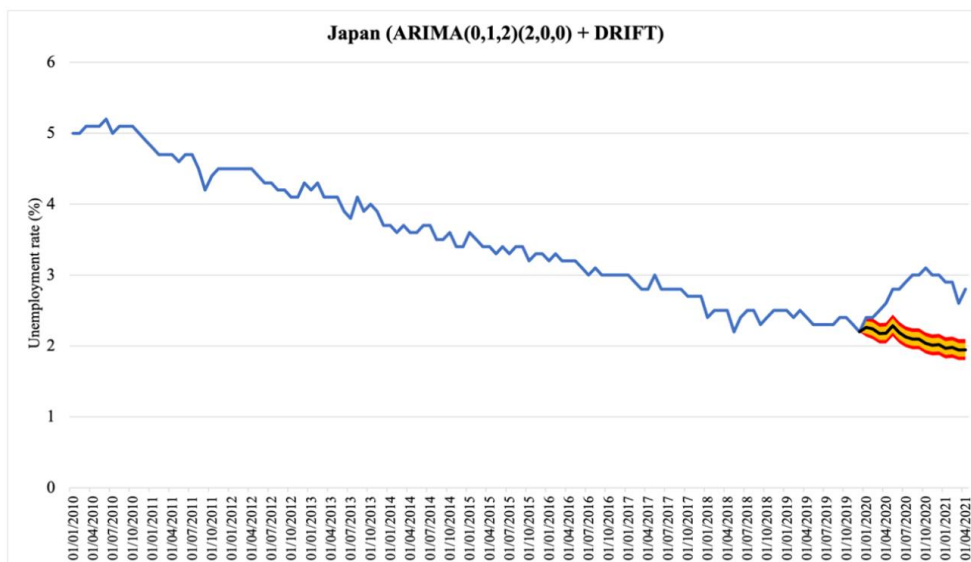


Figure 2. ARIMA – Japan. Source: own work

According to Australian data, the rise in unemployment is higher (nearly 2.5 percentage points) than in the other two countries studied (Figure 3). This did not occur during the first but during the second wave of the epidemic, just like the changes in Korea and Japan did.

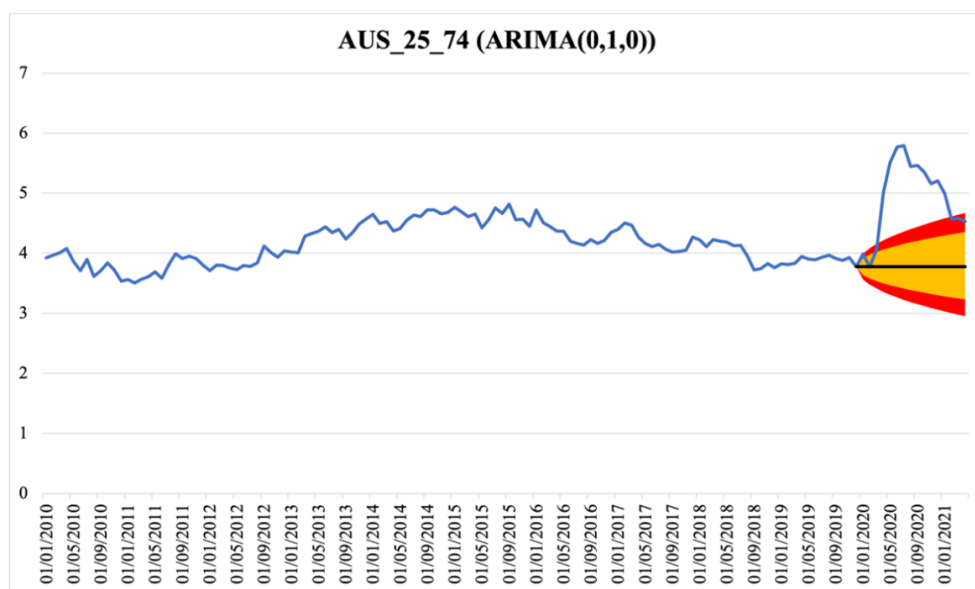


Figure 3. Means of motivations for types of entrepreneurs. Source: own work

A long wave can be seen on the Australian line, which peaked in 2015. Since then, the unemployment rate has been steadily declining, at a somewhat slower pace than in the pre-pandemic Japanese economy. However, this decline was not stopped by the epidemic, because by the end of 2019, the coronavirus had already reached a stagnant labour market. Note that Australian unemployment, like that of Koreans, returned to the range of optimistic estimate by April 2021, although it did not reach the value of the point estimate as in Korea.

In Australia, the government has typically relied on support for workers who were out of work or were inactive, although significant sums (16.4 per cent of the previous year’s GDP) were also spent on payments to the JobKeeper programme (\$130 Billion JobKeeper Payment to Keep Australians in a Job, 2020). These measures and severe short-circuit restrictions allowed for a significant labour market recovery by spring 2021.

5. Discussion

In our study, we used the unemployment data of three economically important countries in the Asia-Pacific region (Japan, Korea, Australia) and then compared them. Our aim was to investigate the relationship between COVID-19 and the development of unemployment, and to establish a predictive method for estimating the expected development of unemployment data to be used for describing a subsequent crisis. For this, we used the time series of the ten years before the onset of the crisis by creating an ARIMA model. An optimistic and a pessimistic scenario can also be outlined based on the estimates relying on time series.

The countries studied are in the same geopolitical region, and the spread of the epidemic was unique in all three: the first wave had little effect on these economies, and then the second wave caused a sharp decline. What these countries also have in common is that their economic power and weight can be deemed significant: the increase in their unemployment rate during the first wave of COVID-19 did not exceed 1.5 percentage points for the two Asian countries and 2.5 percentage points for Australia. However, this is as far as similarities go. Our results show that there are also significant differences between the three countries (Fig. 1-3), i.e. we failed to verify our hypothesis. Every country exhibits unique features. Korea was characterised by mass testing at the time of the first wave. Thanks to the 3T system, the country was able to deal with the first wave of the epidemic without a major economic downturn. However, in the case of further waves, the measures were less successful, so with the spread of the epidemic, unemployment data deteriorated. By the end of 2020, unemployment had reached an all-time high of 5.4 percent in the decade before the epidemic. Japanese protection was based on a third approach. One of the pillars of this was that the country's constitutional order does not allow for the introduction of as rigorous governmental responses as in the case of Australia or Korea. The other pillar was much more frugal testing than in Korea. The Japanese authorities only tested cases exhibiting symptoms. Nevertheless, the epidemiological data for the first wave were very similar to the Japanese statistics. However, the key to Japan's defence was the traditional, disciplined behaviour of the population, which managed to keep the number of first-wave cases relatively low. The Australian prevention strategy was based on strict closures, job protection and income replacement subsidies.

Examining the unemployment data for each country, we have found that the real level of unemployment rate during the pandemic in Australia and Japan was much higher than the most pessimistic scenario in the ten-year time series. This proves that the economic impact of the coronavirus is indeed reflected in the unemployment data. In the case of Korea, due to the variability of the data, our estimation is also less accurate, so the estimation interval of both the pessimistic and optimistic scenarios is wider and the deviation of the actual data from the estimation is less appreciable.

Looking at the results and the data in the literature, we can say that successful protection and successful labour market policy rest on several pillars. Ever since vaccination has been available, it has been the main tool for epidemic protection. Countries that ran a successful vaccination campaign (Australia) were able to lift restrictions more quickly and restart their economies. Of course, vaccination alone is not a guarantee of success: this is well illustrated by the example of Israel, not included in the present work, where the unemployment rate is high even with a high level of vaccination. Prior to vaccination, social isolation and quarantine alone were the only ways for countries to prevent the escalation of the epidemic. However, such measures have only been successful in countries where the population has complied with them conscientiously and voluntarily. The best example of this is Japan. Even without legal coercion, South Korea achieved the same success in the first wave of the epidemic as in Japan, even though there was no mass testing in Japan and the other pillars of 3T were not used. The impact of self-discipline can be clearly demonstrated, as the Japanese constitutional system does not give the government as broad a mandate in emergencies as in the other countries studied. In Australia, discipline was also the main tool in the fight. However, unlike in Japan, the Australian government also had every means to impose and enforce the most stringent lockdown measures. The third way to achieve success was with Korea's consistent application of the 3T system. However, this only successfully treated the first wave of the epidemic, and later, precisely because of a lack of discipline, the population itself contributed to the spread of the infection and the development of the epidemic.

Addressing unemployment has, of course, included policies taken by governments to protect jobs. These were typically economic rescue packages, varying in proportion to the GDP of the country concerned. However, their use is more important than their amount. Countries that have spent much of their rescue package on rescuing jobs, creating jobs, investing, and developing infrastructure will have better chances and faster recovery. Each of the countries we examined falls into this group. Those who typically spent the amount on social benefits and assistance did not motivate workers enough to get a job, so a longer and bitter economic relaunch awaits them.

6. Conclusions

The examined three countries with strong economies have successfully tackled the COVID-19 unemployment. Experience has shown that an economic crisis due to a similar future pandemic can be prepared for in two steps. As a first step, widest possible testing, with disciplined compliance with the lockdown, can screen and isolate sick workers while eliminating the need for general economic downtime and large-scale job closures. In the second step, discipline and screening are accompanied by achieving the fastest and most complete vaccination of the population because, to the best of our knowledge, this is the only effective way to prevent epidemics in the long run. Given that each of the countries studied has been particularly effective in different areas, for this reason sharing experiences and integrating methods may be the most effective help in the fastest and most successful way to deal with future crises such as the coronavirus crisis.

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