GOETHE UNIVERSITÄT FRANKFURT AM MAIN

Economic Consequences of the 1918 Flu Pandemic: Reviewing Evidence from the Historical Precedent of Covid-19

Lukas Jürgensmeier

Abstract

Discussions of the Covid-19-induced health and economic crises often feature the adjective *unprecedented*. However, there exists historical precedent: The 1918 flu pandemic. By examining existing literature on its economic effects, this paper first highlights a consensus that most indicators (GDP, consumption, poverty rates, capital income) were worsening as a result of the 1918 flu pandemic, possibly except for increased wages due to a labor supply shock. However, estimates vary largely by study and evidence remains inconclusive. This paper secondly discusses similarities and differences between the 1918 flu pandemic and Covid-19. I conclude that a direct projection from 1918 to 2020 is difficult and economic predictions based on the historical event might be imprecise. The main reasons are an unusually high mortality rate in 1918–19 of prime working age individuals, and vastly different economic, medical, and societal conditions.

Term Paper
submitted to

Prof. Dr. Volker Casperi
Graduate School of Economics, Finance, and Management
Goethe University
Frankfurt am Main

Historical and Normative Foundations of Economics

June 11, 2020

Contents

List of Figures

List of R Code Chunks

List of Abbreviations

CFR	Case Fatality Rate
GDP	Gross Domestic Product
GNI	Gross National Income
NPI	Non-pharmaceutical Intervention

1 Introduction

The current Covid-19 pandemic comes with severe medical and economic consequences. Sickened by the SARS-CoV-2 virus, patients worldwide die, while in-person businesses are shut down for significant times. Since most living generations did not witness a similar health and economic emergency, it might be thought of as *unprecedented*. However, there is sufficiently similar precedent in modern history that the few remaining members of the oldest living generation have witnessed: The 1918 flu pandemic. After providing the historical background of the development in 1918–19, this paper first examines the current state of research on the economic consequences of the pandemic a century ago. Secondly, it evaluates to which degree those findings could be transferred to the current crisis. This could provide policy-makers with urgently needed scientific advice on which decisions might be most effective to lessen the economic harm caused by the pandemic. However, the current crisis is no identical repetition of the 1918 flu pandemic. Thus, the last part discusses notable differences between the 1918 flu pandemic and Covid-19 that make a direct projection of economic consequences difficult.

2 Development of the 1918 Flu Pandemic

Beginning in March 1918, a novel virus likely emerged in mid-western parts of the United States (Barry 2004) and spread virulently. Sped up by large troop movements to Europe due to World War I, it reached almost every part of the world within six months (Patterson & Pyle 1991). In the course of three waves in the northern hemisphere's spring 1918, fall 1918, and winter/spring 1918/19, the virus infected approximately 500 million people, roughly one third of the entire world population at that time (Taubenberger & Morens 2006). Earlier research estimated the global death toll from the virus between 21.5 (Jordan 1927) and later up to 39.3 million (Patterson & Pyle 1991). More recent studies, while acknowledging the large uncertainty, account for greater under-reporting of causalities and hence estimate the global death toll between 50 and 100 million (Johnson & Mueller 2002). It is, therefore, reasonable to assume that the health emergency caused more causalities that the enormous toll of World War I.

While influenza outbreaks before and after the 1918 flu pandemic mainly caused worse courses of the disease and a larger death toll on the very young and elderly population ("U-shape"), the outbreak in 1918 displayed an uncommon W-shape by additionally killing many otherwise healthy young adults aged 20-40 (Taubenberger & Morens 2006). Figure 1 visualizes those two distinct case fatality rates from influenza and pneumonia by age group during the 1918 flu pandemic compared with a regular flu season ten years later, as well as Covid-19 in Germany.

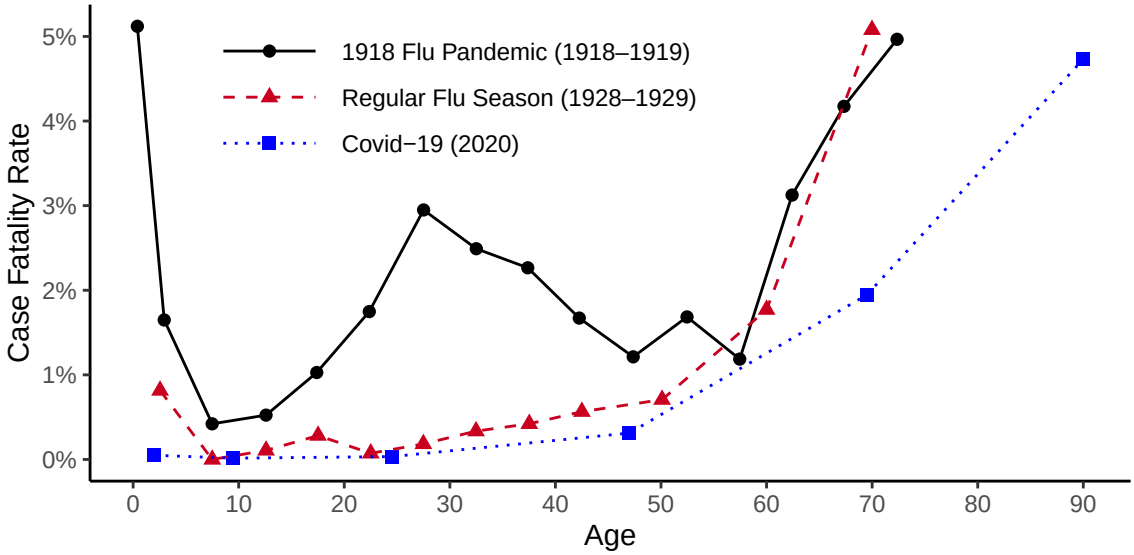

Figure 1: *Case fatality rate (CFR) from influenza and pneumonia during the 1918 flu pandemic ("W-shape") compared to the regular flu season 1928–29 ("U-shape") in the United States and Covid-19 CFR in Germany. CFR for 1918 and 1928 adopted from figure 3, panel C in Taubenberger & Morens (2006), based on data from the US Public Health Service house-to-house surveys. Covid-19 CFR for Germany calculated by the author based on confirmed cases up until June 9th, 2020 with data from Robert Koch Institute (2020)*

Especially the ruthlessness on people in their prime working age in 1918–1919 came with significant implications for the economy, which differ from the consequences of Covid-19. Section 4 further discusses those different economic consequences of the two pandemics. While this part focused on the broader health consequences of the pandemic, the next section examines the economic consequences of the devastating 1918 flu pandemic.

3 Economic Consequences of the 1918 Flu Pandemic

By infecting one third of the world population and killing up to 100 million people, the 1918 flu pandemic not only caused grave health-related suffering, but also significantly influenced the course of the world economy. This section first examines the economic short-term consequences arising during the pandemic, highlighting increased rates of absenteeism and the immediate negative economic effects of non-pharmaceutical interventions (NPI) such as quarantines and temporary business shutdowns. In subsection 3.2, attention turns to the medium- to long-term economic effects, including the development of economic indicators GDP, poverty rate, capital income, and consumption. Further, it discusses loss of life and a potential negative impact on fetal health as factors adversely affecting the long-term economic course.

3.1 Short-term: During the Outbreak in 1918–19

In absence of medical tools to end the outbreak such as vaccines or an effective treatment, one of the only options immediately available to slow the spread are NPIs, including quarantines and mandatory social distancing rules (Aledort et al. 2007). Isolating the effect of NPIs on health outcomes has been and continues to be a challenge in the medical literature: As one of the first studies attempting to establish causality from the 1918 flu pandemic, Markel et al. (2007) claim that US cities with early and continuous NPI measures overall had better health outcomes. In a direct reply, Barry (2007), one of the leading scholars on the 1918 flu pandemic[1], questions the methodology of the study. While he does not per se challenge the notion that NPIs might have had a positive effect on slowing the spread and decreasing the negative health outcomes of the pandemic, he concludes that their methodology does not fulfill scientific standards of establishing a causal relationship. This debate exemplifies how difficult a causal statement about the usefulness of NPIs is in this case due to limited historical data[2].

While medical literature struggles with assessing the efficacy of NPIs, economists have

[1] Barry (2005) is considered to be one of the most extensive and complete historical accounts of the 1918 flu pandemic (Barry 2007, see comment by the editor).

[2] In his reply, Barry (2007) notes that there have only been three significant pandemics in the last century, making the task of establishing causality hard from a mere statistical perspective.

used the natural experiment resulting from the exogenous pandemic shock to produce robust evidence of the 1918 flu pandemic's economic consequences in general, and NPIs in particular. Center to this debate is the trade-off policy-makers face: NPIs result in closed businesses and less immediate economic activity, but also possibly in a less severe course of the disease, fewer deaths, and hence a quicker recovery.

Regardless of the public health aspect, no clear economic intuition is available about whether the direct economic costs outweigh the indirect economic benefits through an earlier end to the pandemic. Addressing this question, Correia et al. (2020) used the different timing of NPI adoption in US cities in 1918–19 to isolate the economic consequences of those measures. They show that cities with an aggressive and timely intervention in form of NPIs not only had a lower mortality rate in 1918–19, but also did not perform worse in the short-term compared to late-adopters. Correia et al. (2020) additionally suggest that long-term economic outcomes were significantly better in cities acting early, which is further discussed in section 3.2.

In general, pandemics are economically characterized as a simultaneous shock to both supply and demand (Eichenbaum et al. 2020). Workers will reduce their labor supply either due to risk of infection or by actually contracting the disease. Simultaneously, demand decreases since consumers cannot, e.g. due to quarantines or social distancing measures, or do not want to consume goods and services, e.g. due to perceived risk of contracting the virus. While this combination can cause a persistent, long-term recession (Eichenbaum et al. 2020), especially the short-term labor supply shock was highly visible during the 1918 flu pandemic.

Since the prime working age population's health was severely negatively affected by the pandemic (Taubenberger & Morens 2006), industries struggled with an acute shortage of labor supply. Absentee rates in key industries were strikingly high: According to Barry (2009), shipyard workers in the United States were explicitly told that their work was as essential as a soldiers' duties, physicians were on-site, and they only received pay if present. Nevertheless, 45%–58% of those shipyard workers were absent at the peak of the pandemic in late 1918 (Turner 1919). While this is inconclusive evidence of a general labor supply shock, it provides one of the few available data points

pointing into this direction.

Due to lack of unambiguous data on the short-term effects, economists have highlighted individual anecdotal evidence through newspaper articles. Garrett (2007) reviews newspapers in 1918–19 in Little Rock, Arkansas, and Memphis, Tennessee, mentioning adverse effects on railway, mining and telephone service through lack of labor supply. Additionally, Garrett (2007) summarizes reported negative effects on consumption, noting that local department stores and merchants saw a decrease in revenue between 40% and 70%.

While one could expect significant short-term negative effects on the overall economy based on these individual accounts, Benmelech & Frydman (2020) note that—contrary to that expectation—at least the US economy did not suffer to the expected degree in the short term. The authors highlight World War I and the associated major role of the US government as the main procurer and significant employer that did not cut back spending due to the pandemic. In 1918, 38% of Gross Domestic Product (GDP) were real government expenditures and the military directly employed 6% of the American workforce (Benmelech & Frydman 2020). Also, individual war-unrelated industries and businesses were hit by the pandemic, rebound was quick and the aggregate economy even grew by approximately 1% in 1919 (Romer 1988). However, this growth rate was probably not caused by, but rather occurred *despite* of the pandemic. Also, the United States might have been an outlier globally: Barro et al. (2020) look at 42 countries and find a negative average pandemic effect on GDP of 6% and approximately 8% less consumption, isolated from negative World War I effects. However, those estimates were derived from a sample between 1901 and 1929, and thus would be better categorized as medium- to long-term economic consequences, on which the following section focuses.

3.2 Medium- to Long-term: After the Immediate Health Thread Subsided

While the short-term disruptions to the economy are described as having an overall negative impact, medium- and long-term consequences were both negative and pos-

itive from a social and political point of view. This section discusses literature that supports the notion of a negative 1918 flu pandemic impact on indicators such as GDP, capital returns, consumption (Karlsson et al. 2014, Barro et al. 2020, Correia et al. 2020) and income loss (Fan et al. 2016). However, literature also acknowledges a possible positive impact on wages through decreased labor supply (Brainerd & Siegler 2003). Those findings seem to be consistent for previous major pandemics (Jordà et al. 2020). Lastly, this part concludes with the discussion of very long-term negative 1918 flu pandemic consequences through in utero exposure to the disease and related impact on socioeconomic outcomes (Almond 2006).

Despite its historic significance, literature has only started paying closer attention on the economic consequences of the pandemic in 1918–19 during the past two decades[3] and even more so recently due to Covid-19. Karlsson et al. (2014) look at well-documented economic indicators in Sweden around the 1918 pandemic, exploiting both the fact that the country was neutral in World War I and the large geographic differences in severity and timing of the disease to isolate the pandemic's direct effect on economic indicators. They estimate an 11% reduction of capital income in worse affected counties compared to lesser struck areas of Sweden[4]. While this effect is mainly during the pandemic, they find evidence of a smaller permanent reduction in the medium-term. In addition, they find a strong and persistent medium-term increase in poverty rates that only becomes visible after the 1918 flu pandemic. Acknowledging one possible mechanism that leads to increased poverty—deceased breadwinners that leave dependents behind without income—Karlsson et al. (2014) argue that the effect was larger than could have been explained by this mechanism and therefore attribute most of the increased poverty to the pandemic *per se*. Karlsson et al. (2014) again use the Swedish data to identify an increase in poverty rates of 9.7%[5] due to the pandemic. Notably, this effect only came into effect after the 1918 flu pandemic ended.

[3]Brainerd & Siegler (2003) note that prior to 2002, only *two* known economics papers dealt with the 1918 flu pandemic's effects on the economy and neither of the three leading economic history textbooks at that time even mentioned the event.

[4]More precisely, this estimate refers to the comparison of two counties by excess mortality rate. There is an 11% difference in capital income between the 75% and 25% percentile county, ordered by excess mortality.

[5]Analogous to the difference in capital income, this refers to the difference between the 75% and 25% percentile county ordered by excess mortality.

However, this finding is at first sight contradictory to a pandemic-induced medium-term increase in wages. The 1918 flu pandemic exercised a large death toll on working people in their 20s and 30s, additionally sickening a large number temporarily (Taubenberger & Morens 2006). While the latter mechanism impacted only the short-term economy, the death of a significant share of working population led to a well-documented and lasting labor supply shock. Brainerd & Siegler (2003) find a large positive pandemic effect on per capita income growth in the United States during the 1920s. Though the effect size of the pandemic varies largely by empirical specification, this paper does not specify further which point-estimate is considered the most realistic one. Contrary to those results, Karlsson et al. (2014) find no conclusive evidence of increased wages in Sweden following the spread of the disease.

Though not intuitive at first, increased poverty rates are not mutually exclusive with higher wages. Those two findings might be reconciled by hypothesizing an increased disparity in income: People participating in the workforce might have been better off, while other parts of the population—e.g. families without a breadwinner or being otherwise cut-off from economic participation—might have driven the increased poverty rate despite higher average wages. However, empirical evidence remains scant and only looking at the raw estimate by Piketty et al. (2018) exhibits ambiguous developments: The top 1% US earners' income as a percentage of total income in 1919 increased by 2 percentage points compared to the previous year, while decreasing to the earlier level of approximately 18% in the following two years. More research is therefore warranted to isolate the causal effect of the pandemic on income distribution in combination with poverty levels.

Another research thread tries to generalize economic effects of previous pandemics. In theory, this might lead to more robust estimates through larger sample sizes and by not only focusing on a single event with unique medical characteristics. On the other hand, data quality and consistency might suffer from comparing events such as the Black Death in the 14th century to the H1N1 pandemic in 2009. Doing so, Jordà et al. (2020) review 14 major pandemics with more than 100,000 deaths since the 14th century and find a modest increase in wages that stretches over decades after a pandemic ended,

peaking roughly 35–40 years later. In the same analysis, they estimate depressed real interest rate responses to pandemics with a peak approximately 25 years later and a magnitude of around 1–2%. In an attempt to check for robustness, Jordà et al. (2020) compare the results including and excluding the 1918 flu pandemic and reach the same conclusions, suggesting that this event had no structurally different economic consequences than the other studied pandemics.

Focusing more generally on possible future pandemics, Fan et al. (2016) use the 1918 flu pandemic to estimate *inclusive* costs of a pandemic, measuring not only the change in GDP, but also accounting for the costs due to premature mortality. They argue that only around 40% of the total cost of moderately severe pandemics is the easily measurable income[6] decrease, on which the sparse "pandemic economics" literature typically focused. They argue that most models failed to capture the intrinsic economic value of life. As a remedy, the authors draw from environmental and medical economics literature that quantifies the statistical value of a shortened life. Using those estimates, their approach models the cost due to premature deaths during a pandemic and compares this amount to the direct effects on GDP. Overall, Fan et al. (2016) find that this often neglected cost of a pandemic in most cases dominates the directly measurable effects on GDP. Furthermore, they estimate that the more severe a pandemic becomes, the larger the share of cost due to loss of life becomes: In their most severe scenario, only 12% of pandemic-related costs arise due to a decrease in GDP.

Most of the literature focuses on the effects of the pandemic maximum 40 years after the event ended. Taking a different approach, Almond (2006) uses the three US 1960–1980 censuses to estimate the very long-term consequences beyond 40 years through *in utero* exposure to the 1918 flu virus. By comparing birth cohorts close to the pandemic with the ones whose mothers could have been infected, the author finds consistently worse socioeconomic outcomes for the affected cohort in almost all indicators recorded. Long-term, he concludes that the likelihood of being poor increase by up to 15%, children affected are 15% less likely to finish high school, and male wages are 5–

[6]Fan et al. (2016) use the term *income* for Gross National Income (GNI) instead of GDP, not to be confused with wages. For simplicity, I use GNI and GDP as proxies for each other, while noting that the two are not identical. For the purpose of this argument, the difference is negligible.

9% lower due to in utero exposure to the virus. Notably, the 1918 flu cohort had a 20% higher rate of disability in the 1980 census compared to the otherwise equal cohorts shortly before and after the pandemic. Thereby, Almond (2006) sheds a light on possibly often omitted very long-term health and economic disadvantages that the affected cohorts carry over long after the pandemic ended.

4 Differences of the 1918 Flu Pandemic to Covid-19

It might be tempting to map the economic consequences of the 1918 flu pandemic to today's crisis. After all, both are considered worldwide pandemics causing severe respiratory diseases. This section outlines why this would ignore several key differences in the medical characteristics of both diseases and structurally different social conditions, that combined make a direct comparison of the economic impact—attempted by Barro et al. (2020)—more difficult.

One of the surprising medical characteristics of the 1918 virus remains the unusual deadliness for patients in their 20s and 30s (Taubenberger & Morens 2006). Contrarily, preliminary results show that the Covid-19 mortality distribution has its highest mass on the higher end of the population age and the probability of death for people far away from retirement age remains low (Weiss & Murdoch 2020, Zhou et al. 2020). See figure 1 for a direct comparison of the respective case fatality rates by age group. This has far reaching implications for the economic consequences. One effect of the 1918 flu pandemic was a medium- to long-term labor supply shock, since a significant share of the working population deceased as a result of infection. As discussed in the previous section, this might have led to substantially higher wages in the following years, making it one of the few economic silver linings from a workers' point of view. Healthwise, today's younger generation is more lucky. However, this might translate to even more devastating labor market consequences, since the labor supply shock might be small and, if existent at all, only temporary.

Nevertheless, other conditions accompanying the pandemic draw a more optimistic picture. Most notably, the Covid-19 pandemic emerged during a decade-long economic expansion, while the 1918 flu pandemic coincided with the final year of World

War I. The conflict led officials in many participating countries to censor the press in an attempt of keeping up the public's morale (Chafee 1919). Researchers cite this fact as a possible reason for a worse course of the disease (Madhav & Markey 2013), since the population was not prepared and aware of the virus early enough. This possibly in turn led to worse economic consequences than one would expect with a well-aware public. Compared to the wartime year 1918, today's press might overall be freer than in wartime and through technological advances reports quicker on the developments, ensuring a better-informed public.

5 Conclusion

This paper has shown that there appears to be a consensus in the literature: The 1918 flu pandemic in particular and pandemics in general overall negatively affect the economy with the possible exception from workers' point-of-view of increased wage levels due to labor supply shortages. However, this part of the economic literature appears to be at an early stage. The scarceness of historical precedent combined with the lack of detailed economic data on pandemics long time ago makes it challenging to reliably estimate effects across pandemics or countries. Furthermore, drawing conclusions for the current and future pandemics remains a difficult endeavor. Many structural differences between the 1918 and 2020 pandemics make a sound economic prediction a challenging task. Medical virus characteristics differ, such as the heterogeneous mortality of the virus for different segments of the population. Also, medicine has advanced hugely in the previous 100 years. Those non-economic differences might imply vastly different economic outcomes. Furthermore, technological advances outside medicine, notably the possibility of many white-collar jobs to continue working from home, make a direct prediction of the economic consequences based on the historical data very difficult. Though there already exist several promising approaches to derive sound policy recommendations for the current pandemic, bridging the gap between the two pandemics often requires educated guesswork. Given the significant uncertainty that society faces today, an expedited further examination of the historical precedent of Covid-19 is warranted and might help to increase the quality of those

educated policy guesses with sound scientific advice.

A Appendix

A.1 R Code

Listing 1: *Data Preparation Figure 1: Case Fatality Rates of Pneumonia and Influenza during the 1918 Flu Pandemic, 1928, and Covid-19 in 2020*

```
1
2  # plotting CFR of 1918 flu vs. regular flu --------------------------------
3  # based on figure 3, panel C in Taubenberger & Morens (2006)
4  # data digitized from screenshot with https://apps.automeris.io/wpd/
5
6  library(dplyr)
7  library(ggplot2)
8  library(tidyr)
9  library(stringr)
10
11 # import data ------------------------------------------------------------
12
13 df1918 <- read.csv("CFR1918.csv", header = F, sep = ";", dec = ",", col.names = c("age", "
       cfr1918"))
14 df1928 <- read.csv("CFR1928.csv", header = F, sep = ";", dec = ",", col.names = c("age", "
       cfr1928"))
15 rki <- read.csv("rki-ind.csv") # German covid-19 data from RKI database
16
17 # correct negative value to 0
18 df1928$cfr1928 <- ifelse(df1928$cfr1928 < 0, 0, df1928$cfr1928)
19
20
21 # data wrangling rki data -------------------------------------------------
22 rki %>%
23 mutate(time = as.Date(Meldedatum),
24 Datenstand = as.Date(Datenstand, format = "%d.%m.%y")) %>%
25 group_by(time, NeuerFall, Datenstand, Altersgruppe) %>%
26 summarize(new_confirmed = sum(AnzahlFall),
27 new_deaths = sum(AnzahlTodesfall)) %>%
28 mutate(confirmed = cumsum(new_confirmed),
29 deaths = cumsum(new_deaths)) -> rki_new_sum
30
31 rki_new_sum %>%
32 ungroup() %>%
33 group_by(Altersgruppe) %>%
34 summarize(confirmed = sum(confirmed),
35 deaths = sum(deaths)) %>%
36 separate(Altersgruppe, c("age_from", "age_to"), "-A") %>%
37 filter(age_from != "unbekannt") -> df2020
38
39 df2020$age_from <- df2020$age_from %>% substr(2, 3) %>% as.numeric()
40 df2020$age_to <- df2020$age_to %>% as.numeric()
41 df2020$age_to[6] <- 100
42
43 df2020 %>%
44 mutate(age_mean = (age_from + age_to)/2) %>%
45 mutate(cfr2020 = deaths/confirmed) %>%
46 rename(age = age_mean) %>%
47 select(age, cfr2020) -> df2020_select
48
49
50 # merge dataframes --------------------------------------------------------
51
52 df <- full_join(df1918, df1928) %>% mutate(cfr1918 = cfr1918/100, cfr1928 = cfr1928/100)
53 df <- full_join(df, df2020_select)
```

Listing 2: *Plotting for Figure 1: Case Fatality Rates of Pneumonia and Influenza during the 1918 Flu Pandemic, 1928, and Covid-19 in 2020*

```
# plotting ----------------------------------------------------------------

df %>%
pivot_longer(cols = cfr1918:cfr2020, names_to = "year", names_prefix = "cfr", values_to = "cfr") %>%
drop_na() %>%
ggplot(aes(age, cfr, color = year, linetype = year, shape = year)) +
geom_point(size = 2) +
geom_line() +
labs(x = "Age", y = "Case Fatality Rate") +
scale_y_continuous(labels = scales::percent_format(accuracy = 1)) +
scale_x_continuous(breaks = seq(0, 90, 10)) +
scale_color_manual(name = "",
labels = c("1918 Flu Pandemic (1918-1919)", "Regular Flu Season (1928-1929)", "Covid-19 (2020)"),
values = c("black", "#CA0020", "blue")) +
scale_linetype_manual(labels = c("1918 Flu Pandemic (1918-1919)", "Regular Flu Season (1928-1929)", "Covid-19 (2020)"),
values = c("solid", "dashed", "dotted")) +
scale_shape_manual(labels = c("1918 Flu Pandemic (1918-1919)", "Regular Flu Season (1928-1929)", "Covid-19 (2020)"),
values = c(16, 17, 15)) +
theme_classic() +
theme(legend.position = c(0.35, 0.85),
legend.key.width = unit(3, "line"),
legend.background = element_rect(fill=scales::alpha(0.1))) +
guides(linetype = guide_legend(""),
color = guide_legend(""),
shape = guide_legend("")) -> p1
```

References

Aledort, J. E., Lurie, N., Wasserman, J. & Bozzette, S. A. (2007), 'Non-pharmaceutical public health interventions for pandemic influenza: An evaluation of the evidence base', *BMC Public Health* **7**(1), 208.

Almond, D. (2006), 'Is the 1918 Influenza Pandemic Over? Long-Term Effects of *In Utero* Influenza Exposure in the Post-1940 U.S. Population', *Journal of Political Economy* **114**(4), 672–712.

Barro, R., Ursúa, J. & Weng, J. (2020), The Coronavirus and the Great Influenza Pandemic: Lessons from the "Spanish Flu" for the Coronavirus's Potential Effects on Mortality and Economic Activity, Technical Report w26866, National Bureau of Economic Research, Cambridge, MA.

Barry, J. M. (2004), 'The site of origin of the 1918 influenza pandemic and its public health implications', *Journal of Translational Medicine* **2**(1), 3.

Barry, J. M. (2005), *The Great Influenza: The Epic Story of the Deadliest Pandemic in History*.

Barry, J. M. (2007), 'Comments on the nonpharmaceutical interventions in New York City and Chicago during the 1918 flu pandemic', *Journal of Translational Medicine* **5**(1), 65.

Barry, J. M. (2009), 'Pandemics: Avoiding the mistakes of 1918', *Nature* **459**(7245), 324–325.

Benmelech, E. & Frydman, C. (2020), 'The 1918 influenza did not kill the US economy'.

Brainerd, E. & Siegler, M. V. (2003), 'The economic effects of the 1918 influenza epidemic', *Centre for Economic Policy Research* (Working Paper 3791).

Chafee, Z. (1919), *Freedom of Speech in War Times*, U.S. Government Printing Office, Washington, DC.

Correia, S., Luck, S. & Verner, E. (2020), 'Pandemics Depress the Economy, Public Health Interventions Do Not: Evidence from the 1918 Flu', *SSRN Electronic Journal* .

Eichenbaum, M. S., Rebelo, S. & Trabandt, M. (2020), 'The Macroeconomics of Epidemics', *NBER Working Papers* (26882).

Fan, V., Jamison, D. & Summers, L. (2016), The Inclusive Cost of Pandemic Influenza Risk, Technical Report w22137, National Bureau of Economic Research, Cambridge, MA.

Garrett, T. A. (2007), 'Economic Effects of the 1918 Influenza Pandemic', *Federal Reserve Bank of St. Louis* .

Johnson, N. P. A. S. & Mueller, J. (2002), 'Updating the Accounts: Global Mortality of the 1918-1920 "Spanish" Influenza Pandemic', *Bulletin of the History of Medicine* **76**(1), 105–115.

Jordà, Ò., Singh, S. R. & Taylor, A. M. (2020), 'Longer-run economic consequences of pandemics', *Federal Reserve Bank of San Francisco Working Paper 2020-09* .

Jordan, E. O. (1927), 'Epidemic Influenza. A Survey.', *Epidemic Influenza. A Survey* .

Karlsson, M., Nilsson, T. & Pichler, S. (2014), 'The impact of the 1918 Spanish flu epidemic on economic performance in Sweden', *Journal of Health Economics* **36**, 1–19.

Madhav, N. & Markey, M. (2013), 'Modeling a Modern Day Spanish Flu Pandemic', *Air Worldwide* .

Markel, H., Lipman, H. B., Navarro, J. A., Sloan, A., Michalsen, J. R., Stern, A. M. & Cetron, M. S. (2007), 'Nonpharmaceutical Interventions Implemented by US Cities During the 1918-1919 Influenza Pandemic', *Journal of Translational Medicine* **298**(6), 644–654.

Patterson, K. D. & Pyle, G. F. (1991), 'The Geography and Mortality of the 1918 Influenza Pandemic', *Bulletin of the History of Medicine* **65**(1), 4–21.

Piketty, T., Saez, E. & Zucman, G. (2018), 'Distributional National Accounts: Methods and Estimates for the United States', *The Quarterly Journal of Economics* **133**(2), 553–609.

Robert Koch Institute (2020), 'Covid-19 Cases up until June

9th in Germany by Age Group', https://npgeo-corona-npgeo-de.hub.arcgis.com/datasets/dd4580c810204019a7b8eb3e0b329dd6_0.

Romer, C. D. (1988), 'World War I and the postwar depression A reinterpretation based on alternative estimates of GNP', *Journal of Monetary Economics* **22**(1), 91–115.

Taubenberger, J. K. & Morens, D. M. (2006), '1918 Influenza: The Mother of All Pandemics', *Emerging Infectious Diseases* **12**(1), 15–22.

Turner, C. E. (1919), 'Report Upon Preventive Measure Adopted in New England Shipyards of the Emergency Fleet Corporation Record'.

Weiss, P. & Murdoch, D. R. (2020), 'Clinical course and mortality risk of severe COVID-19', *The Lancet* **395**(10229), 1014–1015.

Zhou, F., Yu, T., Du, R., Fan, G., Liu, Y., Liu, Z., Xiang, J., Wang, Y., Song, B., Gu, X., Guan, L., Wei, Y., Li, H., Wu, X., Xu, J., Tu, S., Zhang, Y., Chen, H. & Cao, B. (2020), 'Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: A retrospective cohort study', *The Lancet* **395**(10229), 1054–1062.

Statutory Declaration

Ich versichere hiermit, dass ich die vorliegende Arbeit selbsändig und ohne Benutzung anderer als der angegebenen Quellen und Hilfsmittel verfasst habe. Wörtlich übernommene Sätze oder Satzteile sind als Zitat belegt, andere Anlehnungen, hinsichtlich Aussage und Umfang, unter Quellenangabe kenntlich gemacht. Die Arbeit hat in gleicher oder ähnlicher Form noch keiner Prüfungsbehörde vorgelegen und ist nicht veröffentlicht. Sie wurde nicht, auch nicht auszugsweise, für eine andere Prüfungs- oder Studienleistung verwendet.

I herewith declare that I have completed the present term paper independently, without making use of other than the specified literature and aids. Sentences or parts of sentences quoted literally are marked as quotations; identification of other references with regard to the statement and scope of the work is quoted. The thesis in this form or in any other form has not been submitted to an examination body and has not been published. This thesis has not been used, either in whole or part, for another examination achievement.

Frankfurt am Main, June 11, 2020

Lukas Jürgensmeier