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ABSTRACT

The cross-sectional association between pain and unemployment is well-established. But the absence of panel data containing data on pain and labor market status has meant less is known about the direction of any causal linkage. Those longitudinal studies that do examine the link between pain and subsequent labor market transitions suggest results are sensitive to the measurement of pain and model specification. We contribute to this literature using large-scale panel data from the German Socio-Economic Panel (GSOEP) for the period 2002 to 2018. We show that pain leads to job loss. Workers suffering pain are more likely than others to leave their job for unemployment or economic inactivity. This probability rises with the frequency of the pain suffered in the previous month. The effect persists having accounted for fixed unobserved differences across workers, is apparent among those who otherwise report good general health and is robust to the inclusion of controls for mental health, life satisfaction and the employee's occupation.

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1. Introduction

It is well-known that job loss negatively affects subjective wellbeing. It lowers life satisfaction beyond what could be expected purely from the income loss (Winkelmann and Winkelmann, 1998), and it has a long-term scarring effect on psychological wellbeing (Clark et al., 2001). Whereas people become habituated to most life events such as marriage, divorce, widowhood and the birth of a child, such that wellbeing returns to its baseline level, there is little evidence of adaptation to unemployment until one gets back into work (Clark et al., 2008). Job loss also results in deteriorating physical health, resulting in an increased number of visits to physicians, taking more medication and spending more time in bed sick than employed individuals (Linn et al., 1985). Job loss also leads to physiological dysregulation, as indicated in biomarkers post layoff (Michaud et al., 2016).

However, recent research indicates that the links between health and job loss are bi-directional. For example, Andreeva et al. (2015) find that, while layoff increases mental health problems, those with pre-existing depression have a higher likelihood of job displacement. Similarly, Clark and Lepinteur (2019) find that, whilst unemployment early in life impacts life satisfaction at age 30, one's emotional health in childhood protects adults from unemployment at age 30. Böckerman and Illmakunnas (2009) also find those with poor self-assessed health have higher probabilities of subsequent unemployment. As they put it: "persons who have poor health are being selected for the pool of the unemployed" (2009: 161).

A related literature points to a strong correlation between being out of the labor force and the experience of physical pain. For instance, Krueger (2017) finds pain incidence in the United States is twice as high among men not in the labor force (NILF) compared with men in the labor force including the employed and unemployed. There is a similar, though slightly smaller differential, among women. Using Gallup Daily Tracker data for the United States over the period 2010-2017 Blanchflower and Bryson (2021) show the unemployed suffer greater pain than the employed across the life-course, with pain incidence being highest among the NILF from age 30 onwards. They find that in the rest of the OECD pain incidence is higher among non-workers than workers from one's mid-30s.

Despite the literature showing poor health can raise subsequent unemployment probabilities, and the recent studies finding a correlation between pain and joblessness, studies examining the potential impact of pain on subsequent joblessness are scarce. We contribute to this literature by analyzing data for Germany. First, we present cross-sectional evidence to show that the incidence of pain reported by Germans places them in the middle ranks of the pain expressed across countries. Then we analyze panel data from the German Socio-Economic Panel (GSOEP) for the period 2002 to 2018. We find pain leads to job loss. Workers suffering pain are more likely than others to leave their job for unemployment or economic inactivity. This probability rises with the frequency of the pain suffered in the previous month. Those reporting suffering pain 'always' over the course of a month are 4-5 percentage points more likely than those suffering no pain to be found unemployed or economically inactive a year later. The effect persists having accounted for fixed unobserved differences across workers. It is also apparent among those

who otherwise report good general health and is robust to the inclusion of controls for mental health, life satisfaction and the employee's occupation. Furthermore, the relationship between physical pain and subsequent job loss is stronger among workers who are underemployed, that is, those who work substantially fewer hours than they wish to. The effect size is more than double that found for people who work closer to their desired hours.

The remainder of the paper is set out as follows. Section Two reviews the existing literature, focusing on studies examining links between pain and labor market transitions. Section Three presents our data and approach to estimation. Section Four presents our results and Section Five concludes.

2. Literature

The recent literature indicates a strong association between physical pain and joblessness: the unemployed and those who are not in the labor force (NILF) report a higher incidence of pain than those in employment, both in the United States and across the rest of the OECD (Blanchflower and Bryson, 2021). In a cross-sectional study of patients with chronic pain in Quebec four pain diagnoses (musculoskeletal, myofascial, neuropathic and visceral) were all correlated with unemployment, as was pain intensity (Giladi et al, 2015).[1] The issue is particularly salient in the United States where those who suffer physical pain have poorer quality of life than others and are more likely to face deaths of despair (Case and Deaton, 2015, 2017, 2020). Atlas and Skinner (2010) note that pain is much greater among low education and income groups in the United States. However, despite the potential bidirectional association between pain and joblessness, there is little evidence as to the effect of pain on subsequent unemployment. As Giladi et al. (2015: 655) state: "*the direction of association between chronic pain…and unemployment cannot be determined from [cross-sectional] data…. Future research using longitudinal designs is needed to determine the nature of the relationship between pain….and unemployment status*".

High levels of pain have been linked to increased opioid use in the United States (Krueger, 2017). If successful at alleviating pain, opioid use might be positively associated with labor market participation. In fact, the opposite is the case: county-level opioid prescription rates are causally linked to lower employment-to-population rates and higher unemployment rates, perhaps resulting from their narcotic side-effects and high risk of dependency (Harris et al., 2020). In contrast, Garthwaite (2012) and Bütikofer and Skira (2018) find Cox-2 inhibitors are positively associated with workplace attendance, but these are not addictive, suggesting that the alleviation of pain can increase labor supply if narcotic side-effects are absent. In a similar vein, Watson et al. (2004) have shown that the alleviation of chronic lower back pain suffered by the unemployed through a pain management rehabilitation programme can aid their return to work.

[1] Other cross-sectional studies identifying an association between pain, or chronic pain, and unemployment or joblessness include Johannes et al. (2010) and Landmark et al. (2013). Krueger and Mueller (2012) report evidence of an association between unemployment and the emotion of being 'in pain' in the American Time Use Survey. Hoang and Knabe (2021) replicate their finding with the ATUS and note that "the unemployed appear sadder and more in pain than the employed".

As noted in the introduction, some longitudinal studies confirm that unemployment adversely impacts psychological function. For instance, in a small prospective study, men who became unemployed made significantly more visits to their physicians, took more medication, and spent more days, sick in bed than did employed individuals matched on age and race, even though their diagnoses did not differ, leading the authors to conclude that "*the unemployed [were] becoming more anxious, depressed and concerned with bodily symptoms than those who continued to work*" (Linn et al., 1985: 504).

Conscious of the potential for poor health and unemployment to affect one another over the life-course, Virtanen et al. (2013) examine health status as a predictor of the occurrence of unemployment between age 31-42, conditioning on earlier periods of unemployment. They find that among their small cohort of individuals in Northern Sweden there is health-related selection into unemployment in early middle-age, irrespective of unemployment earlier in the life course, including a significant association between musculoskeletal pain and subsequent prolonged unemployment. However, musculoskeletal pain and the simple occurrence of unemployment were not statistically significant.

Any effect of pain on labor market transitions is liable to vary with the intensity of the pain and the duration over which it is felt. In their study based on patients attending pain clinics in the Pacific Northwest of the United States, Von Korff and Dunn (2008) show that their Pain Risk Score, based on pain intensity, pain-related activity limitations, depressive symptoms, number of pain sites and number of pain days was a better predictor of unemployment or being unable to work six months later than pain days alone.

Perhaps the most robust evidence of a clear link between pain and subsequent unemployment is the study by Kaspersen et al. (2015), involving a 14-year follow up examining the impact of health on the subsequent risk of unemployment. Having conditioned on a very wide range of physical and psychological health problems they find musculoskeletal pain has an independent effect in raising the time spent in unemployment over the subsequent 14 years. However, the effect was confined to those reporting three or more musculoskeletal pain symptoms and, even here, the results were sensitive to model specification (p. 316). It is possible that some studies with coarser pain metrics might miss such effects.

The evidence for Germany, which is the setting for our study, largely consists of analyses of the GSOEP data we use. Results tend to correspond with the evidence we have from other countries. Entry into unemployment – including job loss associated with plant closures – leads to a decline in subjective wellbeing (Kassenboehmer and Haisken-DeNew, 2009; Winkelmann and Winkelmann, 1997). This is even the case among Germans who suffer unemployment just prior to retirement: involuntary unemployment between the last job and retirement causes a loss of life satisfaction after retirement which exceeds that which could be explained by the loss of income due to reduced pensions (Hetschko et al., 2019).

In his GSOEP study for the period 1991-2008 Schmitz (2011) challenges the idea that there is a causal link between unemployment and subsequent poor physical health. Using fixed

effects panel estimation and plant closures as a source of exogenous variance in unemployment he finds no negative effect of unemployment on health satisfaction, mental health (captured by GSOEP's Mental Component Summary Scale (MCS)) or hospital visits).[2] He concludes that the correlation between ill health and unemployment is driven by selection of ill individuals into unemployment. But this conclusion is challenged by Stauder (2019). He also uses fixed effects models to estimate health outcomes of unemployment in GSOEP, but for the period 2002-2014. He confirms there is selection of unhealthy people into unemployment, but he also finds physical health deteriorates with unemployment, but only after some time spent unemployed – not around the time of unemployment entry or shortly afterwards. The Physical Component Summary (PCS) Scale provided in the GSOEP data that he uses as his dependent variable incorporates physical pain experienced in the four weeks prior to interview.[3] None of these studies considered the consequences of pain for subsequent unemployment in Germany.

3. Germany in context

Before presenting our results on the links between pain and later unemployment and joblessness, it is worth considering the labor market and pain experiences of Germans during the course of our study, relative to the experience of those in other countries.

Chart 1 indicates that the experience of unemployment was rather different in Germany to most other countries in the OECD. Prior to the Great Recession of 2008 Germany was experiencing higher unemployment rates than other OECD countries. It peaked in 2005, falling rapidly in subsequent years, only ticking up a little during the Great Recession before continuing its downward trajectory until the COVID-19 Pandemic hit in 2019. Ever since 2009 Germany's unemployment rate has been considerably lower than the OECD average, and lower than the rates for the United States and Great Britain. We account for trends in aggregate German unemployment in our models with the incorporation of GSOEP wave dummies.

The relative health of the German labor market is also apparent in international comparisons of employment rates. Table 1 shows in Germany these have risen by 11 percentage points between 2005 and 2019, during which time they rose only 3 percentage points across the OECD and in the United Kingdom and were static in the United States. At the beginning of the period employment rates in Germany were 65 percent – identical to the OECD average – but by the end of the period they were 8 percentage points higher.

How does Germany compare to other countries in terms of the incidence of pain? Here we have evidence from three surveys: the International Social Survey Program (ISSP),

[2] An earlier study by Marcus (2013) had come to a different conclusion, finding unemployment after plant closures was linked to a health deterioration in the unemployed and their spouses.

[3] However, Stauder (2019) finds poorer mental health predicts selection into unemployment but does not deteriorate with length of time in unemployment. In contrast, Gebel and Voßemer (2014), who also analyse GSOEP, find mental health deteriorates with unemployment, whereas physical health does not. Stauder (2019: 71) notes that the difference in results is explained by Gebel and Voßemer's focus on change between two points in time, with the second time point being shortly after unemployment entry, so their results are consistent with his own. He says that the same estimation differences also account for the difference between Schmitz (2011) and his own findings on the links between unemployment and physical health.

Eurobarometer and the Gallup World Survey. Blanchflower and Oswald (2019) examined data from the 2011 sweep of the International Social Survey program.[4] They didn't report individual country rankings, but they were as follows where "very often" and "often" were coded as 1, zero otherwise, ranked from highest to lowest. Those in the United States report the highest incidence of pain, while Germany ranks 14th from 29 countries.[5]

In Eurobarometer data for December 2005 to January 2006 previously analyzed by Blanchflower (2009) respondents across 31 countries were asked: '*During the past four weeks how much if at all, has pain interfered with your activities? Extremely, quite a lot, moderately, a little and not at all?*'. We re-examined these data and once again found found that Germany ranked in the middle of the pack of countries in its reported level of pain.[6]

Turning to the Gallup World Poll, Table 2 indicates that 22.5% of Germans said they'd experienced pain the day before, putting Germany joint 29th (with Norway) out of 37 countries, well behind Chile in first spot where 36.8% of respondents reported pain in the previous day. So Germany does not seem to be an outlier in pain terms.

In Table 3 we go a step further running pain equations using the Gallup World Poll, first for all OECD countries pooled (column 1) and then for Germany only (column 2). Those in pain are those who in response to the question "Did you experience the following feelings during a lot of the day yesterday…physical pain?" responded "yes". Compared to those in employment, the unemployed were significantly more likely to experience pain – by 4.5 percentage points – but the coefficient is half the size in Germany and is not statistically significant. The jobless (those identified as Out of the Labor Force, or OLF) also had a higher probability of experiencing pain than the employed, both in the pooled data (.076 t=43.59) but also in Germany (.05, t=7.59). Having accounted for demographic characteristics and labor market status, those in Germany were significantly less likely to report pain in the previous day when compared to the United States reference category (-.076, t=16.43) – 11th lowest among the 36 countries in the study.[7]

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[4] The survey question asked: *During the past 4 weeks, how often have you had bodily aches or pains?* Response codes *Never; Seldom; Sometimes; Often; Very often.*

[5] United States=34.2%; 2. Australia=31.7%; 3. United Kingdom=29.5%; 4. Portugal=28.0%; 5. Norway=27.8%; 6. Sweden=26.6%; 7. Belgium=25.3%; 8. Denmark=24.7%; 9. Poland=23.6%; 10. Chile=23.3%; 11. Finland=22.9%; 12. France=21.9%; 13. Russia=21.5%; 14. Germany=21.1%; 15. South Korea =21.1%; 16. Netherlands=20.4%; 17. Israel=19.0%; 18. Slovenia=18.7%; 19. Bulgaria=17.5%; 20. Turkey=17.5%; 21. Japan=17.4%; 22. Slovak Republic=16.3%; 23. Lithuania=14.0%; 24. Switzerland=13.1%; 25. Taiwan=11.9%; 26. Philippines=11.3%; 27. South Africa=10.9%; 28. Croatia=10.7%; 29. Czech Republic=8.5%

[6] We took these data and regressed the pain variable on the full set of country dummies, with lowest ranked first and the ranking was as follows, noting the ranking was similar when controls for education, gender and labor force status were added. 1st=Ireland; 2=Netherlands; 3=Denmark; 4=Luxembourg; 5=UK; 6=Spain; 7=France; 8=Belgium; 9=Greece; 10=Malta; 11=Austria; 12=Turkey; 13=Italy; 14=Cyprus; 15=Germany; 16=Finland; 17=Turkish Cyprus; 18=Portugal; 19=Estonia; 20=Hungary; 21=Bulgaria; 22=Sweden; 23=Czech Republic; 24=Slovenia; 25=Croatia; 26=Lithuania; 27=Romania; 28=Latvia; 29=Slovakia; 30th=Poland.

[7] Broadly speaking, the correlates of being in pain are similar in Germany as they are in the pooled country regression, the exception being self-employment where pain is higher than for the employed in the pooled country equation but lower in Germany.

The importance of pain for people's welfare and their expectations about the future are captured in columns 3 and 4 of Table 3 which show for the pooled countries of the OECD and Germany respectively the association between pain and expectations regarding life satisfaction in five years. In both equations the experience of physical pain lowers expectations about future life satisfaction, with the effect being a little larger in Germany than in the OECD as a whole (-.0876 compared with -.0699). These results are notable given that they are independent associations having controlled for feels of stress and worry, health problems and Cantril's Ladder which captures how people currently feel about their life relative to the best possible life they could have.

4. Data and Estimation

For our investigation of physical pain and subsequent job loss we make use of the GSOEP. This longitudinal survey is long-running and nationally representative containing much information pertinent to our study.[8] Information regarding the frequency of physical pain has been collected since 2002 and thus our study covers the time period between 2002 and 2018. The estimates we present are for individuals aged between 18 and 70 who were in paid work at the outset: results are similar when we restrict the sample to prime age workers.[9]

4.1: Measures of Unemployment and Joblessness

We estimate models for unemployment, defined as the respondent's main activity being available for and actively seeking work, and a broader measure of joblessness which identifies those who do not have paid employment or self-employment, whether they are available for or seeking work, or not. This wider joblessness metric captures transitions into joblessness where pain may preclude individuals from being available for or seeking work. This wider category does not include those who leave the labor market for retirement or maternity leave.

Shifts from paid work to unemployment or joblessness capture the extensive margin along which physical pain may affect labor supply. But it is also possible that physical pain will affect the intensive margin of hours adjustments, just as the literature above indicates it can affect absence rates. We therefore estimate two sets of additional models. In the first set we estimate models for all workers where the dependent variable is a dummy variable capturing a reduction of 10 or more hours in paid employment, and the second set where the dependent variable captures a change from full-time to part-time employment. Finally, in a further set of models, we try to identify associations between experiencing pain and subsequent underemployment where workers are working 5 or more fewer hours than they would ideally like to be working and compare this to the situation where the amount of hours worked, is closer to the stated ideal amount.

4.2: Measure of Pain

Cognizant of the finding in the literature that pain outcomes are highly variable across time (Von Korff and Dunn, 2008) we use the ordinal measurement of time spent in physical

[8] More information about the GSOEP can be found in Goebel et al. (2019).

[9] They are also robust to confining estimates the employees only having dropped the relatively small number of self-employed.

pain over a four-week period prior to interview. The pain question is asked every two years. Respondents identify whether they have suffered any physical pain over that period and, if so, how often. The five-point ordinal scale runs from 'never' to 'always'. Table 4 indicates the proportions in each category have remained roughly constant over the period, although there has, in general, been a gradual increase in the proportion reporting pain often or always, from 10.5% in 2002 to 13.2% in 2018.

4.3: Estimation and Model Specification

We run linear estimation models for the (0,1) outcomes of unemployment, joblessness, and cuts in hours. Initially we first present raw correlations between the experience of pain and the outcome of interest, before conditioning on real household income, male, marital status (5 dummies), education (3 dummies), age, and a full set of region dummies (16 dummies). All estimates incorporate a full set of dummy variables capturing the survey waves.

OLS estimates, which simply pool the data across individuals, are supplemented by person fixed effects models which capture the association between pain and subsequent labor market transitions within person, thus controlling for fixed unobserved differences across individuals which might otherwise bias our estimates of the association between pain and subsequent unemployment and joblessness.

We modify our baseline estimates in a number of ways to establish how robust any pain association might be with subsequent labor market transitions. First, we assess the persistence of any pain effect over time: it is possible that physical pain may result in a short-term job exit but does it last into the longer-term? To assess this, we consider whether physical pain leads to unemployment in both of the two waves subsequent to its reporting, rather than our baseline of looking at the following year.

Second, it is possible that the experience of pain is simply proxying for poor health in general. To control for this, we test the sensitivity of results to the incorporation of self-assessed general health, measured at the same point as the pain variable, to capture the independent effect of pain over and above general health problems.

Third, in the same spirit, we control for individuals' mental health and their subjective well-being since it is possible that those who say they are experiencing pain, or frequent pain, may be individuals who are simply unhappy or experiencing mental health problems which might be the underlying cause of a move to unemployment or joblessness. If the pain effects persist having controlled for these potentially confounding time-varying health measures it provides greater confidence that we are isolating pain-related effects.

Fourth, it is possible that pain is associated with the occupation that the respondent was performing, and that it is this, rather than the pain itself, that makes an individual susceptible to unemployment or joblessness. We tackle this potential issue by adding occupation dummies to our estimates to isolate pain effects conditional on the occupation an individual performs.

Fifth, we run estimates for older and younger workers separately in the expectation that pain effects may be weaker for younger workers who may be more reliant on their current jobs for income than older workers, making it harder for them to switch to unemployment, or reduce their hours, when compared to older workers who may have greater resources to draw on, or early retirement options or welfare entitlements which are not available to younger workers.

Finally, we consider whether the relationship between physical pain and subsequent job loss differs where workers are initially underemployed, that is, those who work substantially fewer hours than they wish to. We investigate underemployment to inspect if this has a systematic association with the link between pain and subsequent job loss. In doing so, we assess this relationship for two subsamples: those who work at least five hours fewer than what they would like to, the underemployed; and those whose actual working hours are closer to their desired hours. Relatedly, we report findings regarding how pain is associated with a subsequent reduction in hours worked for those that stay employed.

Turning to our investigation of the links between pain and job loss in GSOEP, Table 5 examines whether the frequency of pain felt whilst in paid work leads to unemployment. Those suffering pain, are more likely to become unemployed, with the magnitude of the effect rising with the frequency with which pain was experienced. In the absence of controls those who reported always being in pain were 4.5 percentage points more likely to have become unemployed a year later than those who had been experiencing no pain (column 1). The size of the effect falls by 1 percentage point with the addition of controls (column 2), and by a further percentage point when one introduces person fixed effects to account for potential biases arising from fixed omitted unobserved differences across workers (columns 3 and 4). But, even in the most stringent estimates in column 4 which incorporate baseline controls and person fixed effects pain is strongly and significantly associated with subsequent unemployment.

A very similar story emerges in Table 6 when we examine transitions into joblessness, whether the person is unemployed or not. The size of the pain coefficients is a little larger than in Table 5 indicating that the pain experienced takes them out of the labor market, either through sickness, disability or other circumstances that make them not available for work.

We also investigate if pain leads to persistent unemployment i.e., if the individual reports being unemployed in the two years subsequent to when they were in work and reported their frequency of pain. In comparison to Table 5, the dependent variable for the estimates of Table 7 equals one if the newly unemployed are unemployed in the subsequent year too. The lagged pain coefficients in the pooled OLS analysis indicate that pain while in work leads to persistent unemployment. However, the coefficients for pain fall with the introduction of person fixed effects and become statistically non-significant.

The link between physical pain and subsequent job loss is maintained when accounting for various aspects of health and well-being when in employment prior to job loss. For brevity we report in Table 8 the lagged pain dummy variables obtained via pooled OLS estimation

(the equivalent of column 2 in Table 5) when lagged general health, lagged mental health, and very low life satisfaction is controlled for. These variables, measured when individuals were in paid work, are themselves predictive of a shift to unemployment but the association between lagged pain and subsequent unemployment is robust to their inclusion. The results are also robust to the inclusion of person fixed effects in these models.

Given that occupation may be systematically linked with physical pain, we test the robustness of our baseline results by controlling for the occupation individuals were working in in the previous year. Table 9 shows our baseline estimates are robust to this additional control, although the coefficients are a little smaller than in regressions that don't account for occupation (Table 5), suggesting there is a link between pain and what people do at work.

If workers suffer pain, they may be forced to leave work, at least temporarily, because they are incapacitated. For others the decision may be more marginal and may partly reflect the costs and benefits of leaving their job. These, in turn, may depend in part on how old you are. It is possible that younger workers face the greatest life-time penalties from unemployment if spells unemployed severely affect career progression, whereupon we may find the effects of pain on unemployment are greater for older workers. To see whether this is the case Table 10 reports OLS and person fixed effects coefficients for two subsamples: those aged from 18 to 50; and those aged from 51 to 70. The OLS estimates do suggest that the association between pain and subsequent unemployment is greater for older workers (column 2 versus column 1). The pain coefficients in the fixed effects models suggest a similar picture, though the coefficients for the most intense pain are not quite statistically significant at conventional levels.[10]

Underemployment has been shown to have risen around the world in the years after the Great Recession including in Germany (Bell and Blanchflower, 2021). Underemployment in Europe is measured by the extent to which desired and actual hours differ, or by some measure referring to part-time workers who can't find full-time jobs.[11] Finally, then, we consider whether those who are initially underemployed are affected differently by pain. Columns 1 and 2 in Table 11 demonstrate that among individuals who are underemployed, in the sense that they are working at least 5 fewer hours than they would like, those 'always' feeling pain are 6-9 percent more likely to subsequently experience job loss than those in a similar situation reporting no pain. This contrasts with those who work within five hours of their desired working hours, where this percentage is about 3 percent (columns 3 and 4).

While not the focus of our investigation, subsequent job loss, we have also found that physical pain, in the situation where an individual remains in employment, predicts changes in work hours. Importantly, full-time workers reporting frequent pain are more likely to become part-time employees than those reporting less pain. Similarly, workers

[10] In both cases the p-value is less than 0.15.

[11] Such hours-based measures are not available for the United States. The measure of underemployment that is available is based upon those who report that they are part-time for economic reasons (PTFER). Bell and Blanchflower (2021) use this to construct a variable U7 which simply divides PTFER by employment. They show that empirically this explains slow wage growth post 2008 while the unemployment rate plays no role.

reporting frequent physical pain are more likely to reduce their hours by at least ten (approximately one standard deviation for working hours in our sample) in the next period.

The results we present here are robust. As mentioned previously, all results presented are for workers aged between 18 and 70, though the results are very similar - coefficient sizes are often slightly larger - for prime age workers. Furthermore, results are robust to taking into account potential attrition bias via inverse probability weighting.

5. Conclusions

The cross-sectional association between pain and unemployment is well-established. But the absence of panel data containing data on pain and labor market status has meant less is known about the direction of any causal linkage. A few small-scale studies have found that the alleviation of pain can increase labor supply. Those longitudinal studies that do examine the link between pain and subsequent labor market transitions suggest results are sensitive to the measurement of pain and model specification. We contribute to this literature by revisiting this issue using large-scale panel data from the German Socio-Economic Panel (GSOEP) for the period 2002 to 2018. We also set these results in context using data from the International Social Surveys, the Gallup World Poll and the Eurobarometer Survey. Germany has typical levels of pain. As our literature review indicates, the GSOEP is a data set that features heavily in the examination of links between health and unemployment, but no previous studies used it to examine the consequences of pain for subsequent unemployment.

We show that pain leads to job loss, and this result is robust to model specification, the measure of joblessness we use, and to some sub-population analyses. Workers suffering pain are more likely than others to leave their job for unemployment or economic inactivity. This probability rises with the frequency of the pain suffered in the previous month. Those reporting suffering pain 'always' over the course of a month are 4-5 percentage points more likely than those suffering no pain to be found unemployed or economically inactive a year later. The effect persists having accounted for fixed unobserved differences across workers.

There is also some evidence that the effect persists for two years, although this becomes statistically non-significant when controlling for person fixed effects. It is also apparent among those who otherwise report good general health and is robust to the inclusion of controls for mental health, life satisfaction and the employee's occupation. The relationship between physical pain and subsequent job loss is stronger where workers are initially underemployed, that is, those who work substantially fewer hours than they wish to. The effect size is more than double that found for people who work closer to their desired hours.

The impact of pain appears to be broader than just on job loss as shown here. Blanchflower and Bryson (2021b) have examined evidence from a British birth cohort. The National Child Development Study (NCDS) has continuously followed all the individuals born in a single week in March 1958. Chronic pain – defined as aches and pains lasting for more than three months at age 42 –has an impact on back pain and depression as well as on the

probability of holding a job more than a decade later at age 55. Chronic pain, the authors find, also impacts general health and well-being years later.

Our results appear compelling and should prompt further examination into the complex relationship between pain and job loss. Here we only consider one aspect of pain, namely its frequency in the month prior to interview. This proves important since effects differ with pain frequency, but there are other dimensions of pain, such as its duration and location, which are worthy of investigation. In addition, just because there is a link between workers experiencing pain and subsequent job loss does not mean that we can discount the bi-directional nature of the relationship, something that is worthy of further investigation.

The availability of longitudinal data files seems important if we are to understand the mechanism by which pain impacts subsequent health and labor market outcomes. Our current research using GSOEP and NCDS is exploring other outcomes that pain might impact including sleep, drinking and smoking, drug taking and marital breakdown. Pain hurts.

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Table 1. Employment rates – source OECD

	Germany	USA	UK	OECD
2005	65.5	71.5	72.9	65.1
2008	70.1	70.9	72.6	66.2
2011	72.7	66.6	70.3	64.8
2014	73.8	68.1	72.9	65.8
2017	75.3	70.1	75.0	67.7
2019	76.7	71.4	76.2	68.4

Notes: OECD countries are Austria, Australia, Belgium, Canada, Chile, Colombia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Latvia, Lithuania, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States.

Table 2. Mean pain rates, Gallup World Poll, 2005-2020 (weighted) %.

Q1. Experienced physical pain yesterday – yes/no? (wp68)

Australia	23.9	Hungary	29.7	Poland	19.3
Austria	21.3	Iceland	32.1	Portugal	33.6
Belgium	29.6	Ireland	19.2	Slovakia	27.4
Canada	27.9	Israel	29.8	Slovenia	24.9
Chile	36.8	Italy	25.2	South Korea	24.4
Colombia	30.5	Japan	19.7	Spain	29.3
Czech Republic	24.1	Latvia	22.9	Sweden	21.5
Denmark	24.7	Lithuania	24.2	Switzerland	23.6
Estonia	20.6	Luxembourg	25.8	Turkey	22.6
Finland	23.7	Mexico	28.4	United Kingdom	21.1
France	29.3	Netherlands	20.9	United States	28.3
Germany	22.5	New Zealand	23.0	Total	25.1
Greece	28.3	Norway	22.5		

Table 3. Pain and life satisfaction expectations, GWP 2009-2019

Q1. Did you experience the following feelings during a lot of the day yesterday? How about physical pain? (WP68).

	Pain		Life satisfaction in 5 years	
	(1)	(2)	(3)	(4)
	OECD	Germany	OECD	Germany
Cantril			.7126 (535.79)	.7919 (171.79)
Pain			-.0699 (12.18)	-.0876 (4.47)
Stress			-.0242 (4.55)	-.0244 (1.40)
Worry			-.0480 (8.97)	.0111 (0.60)
Health problems			-.1941 (31.18)	-.1265 (6.58)
Male	-.0313 (23.45)	-.0401 (8.36)	-.0605 (12.86)	.0188 (1.22)
Age	.0076 (37.10)	.0043 (5.64)	-.0249 (33.64)	-.0280 (10.92)
Age^2*100	-.0047 (23.59)	-.0016 (1.97)	-.0047 (0.02)	.0026 (1.03)
Tertiary	-.0691 (33.25)	-.0798 (5.29)	.1670 (22.16)	.0511 (1.01)
College	-.1232 (52.27)	-.1402 (8.99)	.3014 (35.33)	.1943 (3.69)
Self-employed	.0192 (7.15)	-.0224 (2.18)	.0956 (10.17)	.1706 (5.21)
Part-time DNWF	.0261 (10.21)	.0003 (0.04)	-.0466 (5.21)	-.0813 (3.06)
Unemployed	.0448 (13.41)	.0211 (1.46)	.0795 (6.72)	.0895 (1.91)
Part-time WF	.0595 (18.65)	.0391 (3.08)	.0214 (1.92)	.0758 (1.88)
OLF	.0760 (43.59)	.0503 (7.59)	-.1408 (22.60)	-.1424 (6.61)
Married	-.0218 (11.23)	-.0189 (2.70)	-.0356 (5.22)	-.0054 (0.24)
Separated	.0194 (4.18)	.0298 (1.76)	.1067 (6.53)	.1869 (3.43)
Divorced	.0176 (5.78)	.0254 (2.46)	.0143 (1.34)	.0624 (1.87)
Widowed	.0399 (13.18)	-.0052 (0.51)	-.0764 (7.03)	.0465 (1.39)
Domestic partner	.0039 (1.39)	-.0006 (0.05)	.0857 (8.78)	.1112 (3.14)
Australia	-.0674 (11.69)		-.1878 (9.19)	
Austria	-.0841 (15.25)		-.3289 (16.84)	
Belgium	.0095 (1.69)		-.4584 (22.97)	
Canada	-.0059 (1.07)		-.0934 (4.73)	
Chile	.0643 (11.38)		-.0827 (4.12)	
Colombia	.0152 (2.64)		.6992 (34.15)	
Czech	-.0458 (7.88)		-.7775 (37.24)	
Denmark	-.0449 (8.12))		-.0311 (1.59)	
Estonia	-.0792 (13.27)		-.6270 (28.89)	
Finland	-.0768 (13.52)		-.3282 (16.34)	
France	-.0106 (1.95)		-.6216 (32.12)	
Germany	-.0763 (16.43)		-.4619 (27.73)	
Greece	-.0270 (4.78)		1.0344 (51.22)	
Hungary	.0022 (0.38)		--.7600 (36.02)	
Iceland	.0207 (2.67)		-.0678 (2.47)	
Ireland	-.0866 (15.58)		-.1482 (7.54)	
Israel	.0355 (6.29)		-.2063 (10.30)	
Italy	-.0835 (15.34)		-.4178 (21.61)	
Japan	-.1052 (19.51)		-.8207 (41.75)	
Latvia	-.0642 (10.94)		-.3787 (17.66)	
Lithuania	-.0414 (7.19)		-.4797 (22.37)	
Luxembourg	-.0365 (6.24)		-.5427 (26.21)	
Mexico	-.0029 (0.52)		-.1923 (9.65)	
Netherlands	-.0773 (13.66)		-.3529 (17.63)	
New Zealand	-.0751 (13.10)		-.0330 (-1.63)	
Norway	-.0685 (11.11)		-.2429 (11.20)	
Poland	-.0949 (6.81)		-.6661 (32.32)	
Portugal	.0129 (2.33)		-.5116 (25.41)	
Slovakia	.0069 (1.20)		-.6630 (31.74)	

Slovenia	-.0775 (13.86)		-.7422 (37.32)	
South Korea	-.0422 (7.66)		-.4613 (22.76)	
Spain	-.0113 (2.01)		-.4888 (24.26)	
Sweden	-.0700 (12.66)		-.2001 (10.20)	
Switzerland	-.0646 (10.68)		-.2724 (12.72)	
Turkey	-.0673 (12.25)		-.5979 (30.17)	
UK	-.0882 (18.71)		-.1524 (9.03)	
USA				
_cons	.1042	.1299	3.8925	2.8664
N	438,876	31,944	406,933	30,308
R2	.0543	.0359	.5680	.5927

All equations include a full set of year dummies. Equations also include controls for DK and not answered for education and marital status. USA is the excluded category in columns 1 and 3, single, employee and completed elementary education or less.

Q2. Please imagine a ladder, with steps numbered from 0 at the bottom to 10 at the top. The top of the ladder represents the best possible life for you and the bottom of the ladder represents the worst possible life for you. On which step of the ladder would you say you personally feel you
Q3. Please imagine a ladder, with steps numbered from 0 at the bottom to 10 at the top. The top of the ladder represents the best possible life for you and the bottom of the ladder represents the worst possible life for you. Just your best guess, on which step do you think you will stand in the future, say about five years from now? (WP18)
Q4. Did you experience the following feelings during a lot of the day yesterday? How about worry? (WP69).
Q5. Did you experience the following feelings during a lot of the day yesterday? How about stress? (WP71).

Table 4: Frequency of Pain in the Last Month, GSOEP, 2002-2018 (%)

	Always	Often	Sometimes	Almost never.	Never
2002	1.6	8.9	20.4	28.8	40.2
2004	1.9	9.0	19.4	29.8	39.9
2006	1.8	9.6	19.7	27.9	41.1
2008	2.0	9.6	19.5	30.0	38.9
2010	1.9	10.2	20.5	28.5	39.0
2012	2.1	10.3	20.1	28.3	39.1
2014	2.2	10.2	19.8	26.4	41.3
2016	2.6	9.8	20.2	25.1	42.1
2018	2.7	10.5	20.6	26.2	39.9

Note: survey-weighted estimates

Table 5. Lagged physical pain and subsequent unemployment, GSOEP 2002-2018

	Had a job, now unemployed			
	(1)	(2)	(3)	(4)
	OLS	OLS	FE	FE
Physical pain (lag):				
Always	.0452 (5.34)	.0361 (4.28)	.0256 (2.34)	.0255 (2.34)
Often	.0237 (8.91)	.0176 (6.60)	.0073 (2.27)	.0073 (2.29)
Sometimes	.0103 (6.62)	.0063 (3.98)	.0035 (1.71)	.0035 (1.74)
Almost never	.0047 (3.80)	.0029 (2.36)	.0034 (2.38)	.0035 (2.39)
Personal controls	No	Yes	No	Yes
Regional controls	No	Yes	No	Yes
Year controls	Yes	Yes	Yes	Yes
Constant	.0538	.0740	.0160	0.089
N	87,963	87,963	87,963	87,963
R^2	.0045	.0188	.0032	.0026
Dep var mean	.0257	.0257	.0257	.0257

Never is the excluded pain category. The personal controls are household income, gender, marital status, education and age. The regional controls are a set of 16 dummy variables for the 16 states. T-statistics in parentheses. *Q6. During the past four weeks, how often did you have severe physical pain? (Always, often, sometimes, almost never, never.) (ple0030)*

Table 6. Lagged physical pain and subsequent not working, GSOEP 2002-2018

	Had a job, now not working			
	(1)	(2)	(3)	(4)
	OLS	OLS	FE	FE
Physical pain (lag):				
Always	.0578 (6.15)	.0446 (4.75)	.0285 (2.39)	.0284 (2.39)
Often	.0305 (10.18)	.0214 (7.16)	.0108 (2.92)	.0108 (2.94)
Sometimes	.0138 (7.74)	.0080 (4.43)	.0063 (2.78)	.0064 (2.81)
Almost never	.0050 (3.61)	.0028 (2.00)	.0042 (2.49)	.0042 (2.50)
Personal controls	No	Yes	No	Yes
Regional controls	No	Yes	No	Yes
Year controls	Yes	Yes	Yes	Yes
Constant	.0538	.0740	.0160	0.089
N	88,718	88,718	88,718	88,718
R^2	.0047	.0175	.0032	.0028
Dep var mean	.0340	.0340	.0340	.0340

Never is the excluded pain category. The personal controls are household income, gender, marital status, education and age. The regional controls are a set of 16 dummy variables for the 16 states. *Q6. During the past four weeks, how often did you have severe physical pain? (Always, often, sometimes, almost never, never.)*

Table 7. Lagged physical pain and subsequent persistent unemployment, GSOEP 2002-2018

	Had a job, now unemployed for the two subsequent years			
	(1)	(2)	(3)	(4)
	OLS	OLS	FE	FE
Physical pain (lag):				
Always	.0308 (3.76)	.0232 (2.84)	.0025 (0.30)	.0025 (0.30)
Often	.0154 (6.80)	.0097 (4.31)	.0007 (0.34)	.0008 (0.36)
Sometimes	.0060 (4.84)	.0020 (1.62)	-.0011 (0.81)	-.0010 (0.73)
Almost never	.0022 (2.33)	.0005 (0.52)	-.0004 (0.41)	-.0035 (0.24)
Personal controls	No	Yes	No	Yes
Regional controls	No	Yes	No	Yes
Year controls	Yes	Yes	Yes	Yes
Constant	.0092	.0382	.0113	0.0174
N	68,757	68,757	68,757	68,757
R^2	.0040	.0197	.0007	.0036
Dep var (mean)	.0194	.0194	.0194	.0194

Never is the excluded pain category. The personal controls are household income, gender, marital status, education and age. The regional controls are a set of 16 dummies. *Q6. During the past four weeks, how often did you have severe physical pain? (Always, often, sometimes, almost never, never.) (ple0030)*

Table 8. Lagged physical pain and job loss, controlling for health and life satisfaction, GSOEP 2002-2018

	Had a job, now unemployed		
	(1)	(2)	(3)
	OLS	OLS	OLS
Physical pain (lag):			
Always	.0288 (3.22)	.0367 (4.13)	.0344 (4.05)
Often	.0102 (3.51)	.0156 (5.61)	.0170 (6.38)
Sometimes	.0015 (0.88)	.0044 (2.72)	.0060 (3.83)
Almost never	.0010 (0.81)	.0021 (1.68)	.0029 (2.34)
General health (lag)	Yes	No	No
Mental health (lag)	No	Yes	No
Very low life sat. (lag)	No	No	Yes
Personal controls	Yes	Yes	Yes
Regional controls	Yes	Yes	Yes
Year controls	No	Yes	No
Constant	.0770	.0539	.0744
N	86,352	86,352	87,963
R2	.0196	.0191	.0190
Dep var (mean)	.0256	.0256	.0257

Never is the excluded pain category. General health and mental health information comes from the SOEP's generated information for general health (*gh_nbs*) and mental health (*mh_nbs*) available in the same years as the pain information. Individuals are deemed to have very low life satisfaction if they score 0, 1 or 2 on an 11-point life satisfaction scale. The personal controls are household income, gender, marital status, education and age. The regional controls are a set of 16 dummies. *Q6. During the past four weeks, how often did you have severe physical pain? (Always, often, sometimes, almost never, never.)*

Table 9. Lagged physical pain and subsequent unemployment, conditioning on occupation, GSOEP 2002-2018

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	Had a job, now unemployed			
	(1)	(2)	(3)	(4)
	OLS	OLS	FE	FE
Physical pain (lag):				
Always	.0384 (4.56)	.0347 (4.13)	.0246 (2.28)	.0245 (2.27)
Often	.0185 (6.97)	.0162 (6.09)	.0066 (2.06)	.0066 (2.07)
Sometimes	.0064 (4.11)	.0051 (3.25)	.0028 (1.41)	.0028 (1.44)
Almost never	.0032 (2.60)	.0025 (2.07)	.0032 (2.16)	.0032 (2.17)
Occupation controls	Yes	Yes	Yes	Yes
Personal controls	No	Yes	No	Yes
Regional controls	No	Yes	No	Yes
Year controls	No	Yes	No	Yes
_cons	.0128	.0232	-.0229	.0922
N	87,963	87,963	87,963	87,963
R2	.0045	.0188	.0069	.0074
Dep var mean	.0257	.0257	.0257	.0257

Never is the excluded pain category. The personal controls are household income, gender, marital status, education and age. The controls for occupation are a set of 10 dummy variables. The regional controls are a set of 16 dummy variables for the 16 states. *Q6. During the past four weeks, how often did you have severe physical pain? (Always, often, sometimes, almost never, never.)*

Table 10. Lagged physical pain and subsequent unemployment, differences by age, GSOEP 2002-2018

	Had a job, now unemployed			
	(1)	(2)	(3)	(4)
	OLS	OLS	FE	FE
	18-50	51-70	18-50	51-70
Physical pain (lag):				
Always	.0252 (2.40)	.0489 (3.71)	.0214 (1.51)	.0256 (1.45)
Often	.0169 (5.02)	.0181 (4.29)	.0056 (1.41)	.0098 (1.75)
Sometimes	.0079 (3.99)	.0032 (1.24)	.0091 (3.54)	-.0039 (1.14)
Almost never	.0041 (2.75)	-.0029 (6.30)	.0063 (3.30)	-.0021(0.84)
Personal controls	Yes	Yes	Yes	Yes
Regional controls	Yes	Yes	Yes	Yes
Year controls	Yes	Yes	Yes	Yes
Constant	.0538	.0740	.0160	0.089
N	87,963	87,963	87,963	87,963
R^2	.0045	.0188	.0032	.0026
Dep var mean	.0261	.0248	.0261	.0248

Never is the excluded pain category. The personal controls are household income, gender, marital status, education and age. The regional controls are a set of 16 dummy variables for the 16 states. *Q6. During the past four weeks, how often did you have severe physical pain? (Always, often, sometimes, almost never, never.)*

Table 11. Lagged physical pain and subsequent unemployment, subsamples based upon comparisons of actual and desired hours of work, GSOEP 2002-2018

	Had a job, now unemployed			
	(1)	(2)	(3)	(4)
	OLS	OLS	OLS	OLS
	Underemployed	Underemployed	Matched hrs.	Matched hrs.
Physical pain (lag):				
Always	.0865 (3.16)	.0612 (2.25)	.0323 (2.78)	.0249 (2.14)
Often	.0452 (4.89)	.0311 (3.39)	.0203 (5.51)	.0153 (4.15)
Sometimes	.0178 (2.99)	.0090 (1.53)	.0089 (4.36)	.0054 (2.67)
Almost never	.0034 (0.71)	-.0013 (0.28)	.0051 (3.22)	.0036 (2.28)
Personal controls	No	Yes	No	Yes
Regional controls	No	Yes	No	Yes
Year controls	Yes	Yes	Yes	Yes
Constant	.0490	.0832	.0167	0.0591
N	14,017	14,017	38,655	38,655
R^2	.0094	.0552	.0054	.0149
Dep var mean	.0653	.0653	.0194	.0194

Never is the excluded pain category. The personal controls are household income, gender, marital status, education and age. The regional controls are a set of 16 dummy variables for the 16 states. *Q6. During the past four weeks, how often did you have severe physical pain? (Always, often, sometimes, almost never, never.)*

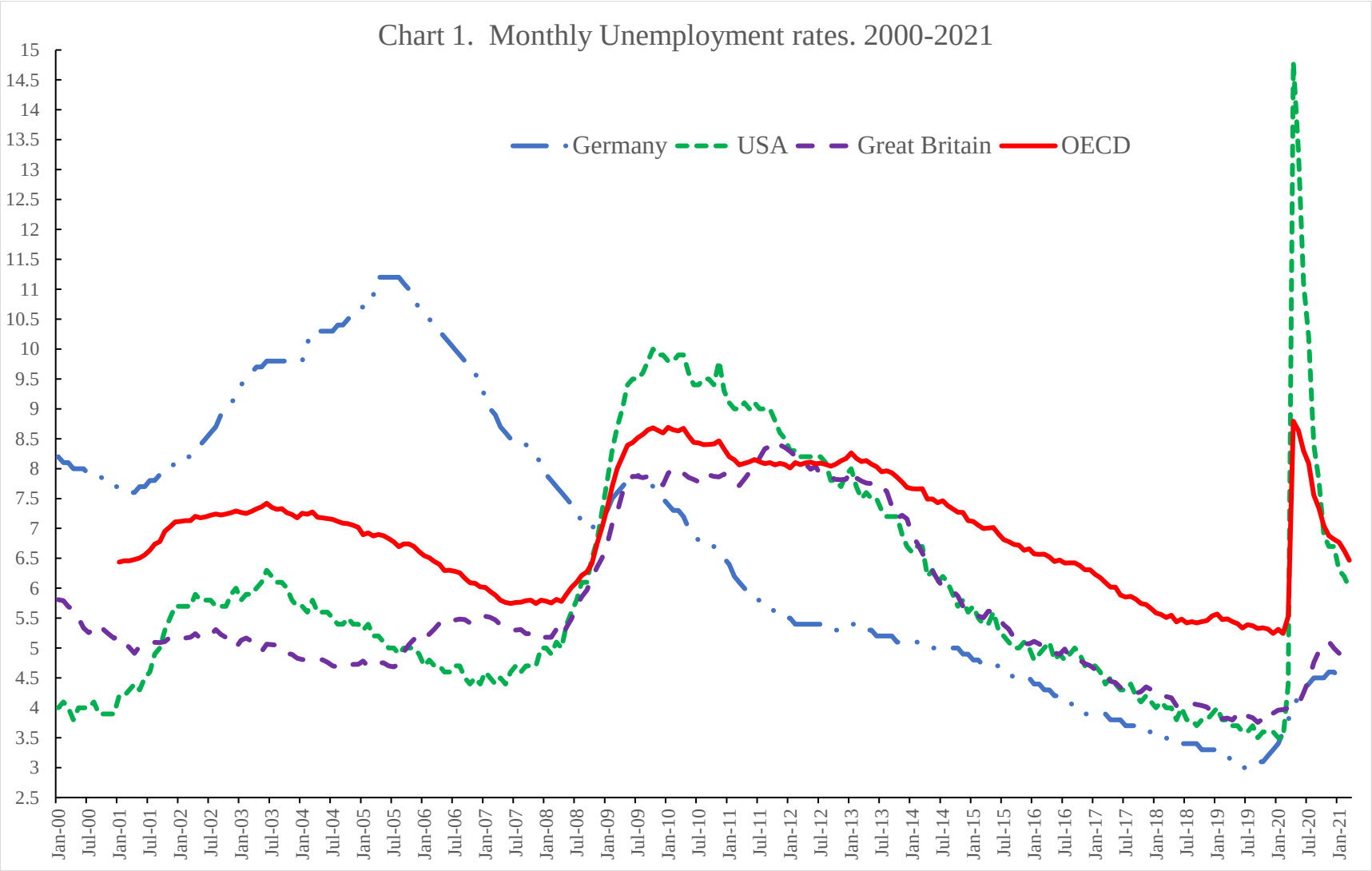
Chart 1. Monthly Unemployment rates. 2000-2021
Germany
USA
Great Britain
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