ABSTRACT

Physical Pain, Gender, and the State of the Economy in 146 Nations

Rationale: Physical pain is one of the most severe of human experiences. It is thus one of the most important to understand. Objective: This paper reports the first cross-country study of the links between physical pain and the state of the economy. A key issue examined is how the level of pain in a society is influenced by the unemployment rate. Method: The study uses pooled cross-sectional Gallup data from 146 countries. It estimates fixed-effects regression equations that control for personal characteristics. Results: More than a quarter of the world's citizens are in physical pain. Physical pain is lower in a boom and greater in an economic downturn. Estimated effect-sizes are substantial. Remarkably, increases in pain are borne almost exclusively by women and found principally in rich nations. These findings have paradoxical aspects. The counter-cyclicality of physical pain is not what would be predicted by conventional economic analysis: during an expansion, people typically work harder and longer, and accidents and injuries increase. Nor are the paper's results due to unemployed citizens experiencing more pain (although they do). Instead, the study's findings are consistent with an important hypothesis proposed recently, using different kinds of evidence, by brain and behavioural-science researchers such as Katja Wiech and Irene Tracey (2009) and Eileen Chou and colleagues (2016). The hypothesis is that economic worry can create physical pain. Conclusions: This study provides the first cross-country evidence that the level of physical pain in a nation depends on the state of the economy. Pain is high when the unemployment rate is high. That is not because of greater pain among people who lose their jobs -- it extends far beyond that into wider society. The increase in physical pain in a downturn is experienced disproportionately by women.

JEL Classification: I10, I31

Keywords: physical pain, unemployment, state of the economy, gender, business cycle, wellbeing, health

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INTRODUCTION

Physical pain is one of the most debilitating of human experiences. That means it is one of the most important to understand (Au & Johnston, 2014; Graham et al., 2011; Gureje et al., 1998; McNamee & Mendolia, 2014; Ólafsdóttir et al., 2020; Simon et al., 1999). Pain is also common (Breivik et al., 2006 find that more than a fifth of citizens in rich nations suffer with chronic pain; Bowling, 1995; Johannes et al., 2010) and is costly to the economy (Gaskin & Richard, 2012). Yet pain has been relatively little-studied in large cross-national samples (one exception, though it is not concerned with the issues covered in later analysis, is Blanchflower & Oswald, 2019). Evidence is largely absent on the possible connection between the economic cycle and levels of physical pain, although important related studies on the role of economic influences have been done (Brekke et al., 2002; Brooker et al., 1997; Carpenter et al., 2017; Case et al., 2020; Dávalos et al., 2012; Hollingsworth et al., 2017; Wilkinson et al., 2020).

This paper explores the hypothesis that there is a link between economy-wide fluctuations and the amount of pain in a society. An economic downturn here is operationalized primarily by using a measure of the unemployment rate. When a nation's unemployment rate is high, the paper finds, the level of physical pain felt by its citizens is also high. Data on approximately 1.3 million adults, in a large sample of countries, are used. Later analysis reveals that physical pain tends to increase during a period of economic slowdown and to decline during an economic expansion. This counter-cyclical pattern is far stronger in rich nations.

A particular concern in the paper is how males and females are affected by rises in the rate of joblessness. Because they play somewhat different roles in family life, and are arguably treated differently in the labour market, we wished to know whether women suffer more in an economic slowdown. Strikingly, they do. Women, rather than men, are predominantly the ones who suffer physical pain in downturns of the economy.

These are not empirical patterns that are currently known by behavioural scientists or economists and we had not anticipated them. Standard economic reasoning would, if anything, tend to predict the reverse. People work longer hours in good times, so pain levels could be expected to track the economy in a pro-cyclical rather than anti-cyclical way. Research has also traditionally shown that many kinds of accidents -- one cause of pain -- are pro-cyclical (although Ruhm 2015 presents an interesting and more nuanced view for modern data, see Ruhm, 2015). A slower economy should, in principle, be easier on the human body. There is a large literature, stemming considerably from the work of Christopher Ruhm, on the fact that recessions seem to be good for population health despite the fact that individual hard economic times tend to be bad for an individual's health (see Burgard et al., 2013 for a review).

It is understood that unemployed people typically report high levels of pain in surveys (Blanchflower & Oswald, 2019, and later results in this paper; Johannes et al., 2010; McNamee & Mendolia, 2014). Researchers are also aware that pain and psychological distress are strongly correlated at the cross-sectional level. Thus physical pain and mental strain do seem, in ways not entirely understood, to be somehow interrelated (Aggarwal et al., 2006; Benjamin et al., 2000; Simon et al., 1999; Tunks et al., 2008; VonKorff & Simon, 1996).

Prior research has examined proxies for pain. One early study by Brooker et al., (1997) explored the impact of the economy on the incidence of lost-time back pain claim rates in the Canadian province of Ontario between 1975 and 1993. Using time-series methods, the authors gathered data on age- and sex-adjusted claims for back pain, stratified by industry sector (construction, manufacturing and trade), and regressed those on the unemployment rate of the industry sector. The study concluded there was no evidence that claims for back pain went up in a recession. Davalos et al. (2012) examined panel data from waves 1 and 2 of the U.S. National Epidemiological Survey on Alcohol and Related Conditions (NESARC). It argued that people seem to self-medicate with alcohol in a recession. Consistent with that, although

also not on pain explicitly, Hollingsworth et al. (2017) showed in US data that as a county's unemployment rate increased by one percentage point the opioid death rate per 100,000 rose by 0.19 (3.6%) and the opioid overdose ED visit rate per 100,000 increased by 0.95 (7.0%). Again not on pain levels per se, Carpenter et al (2017) provided some evidence in US data from 2002 to 2015 that economic downturns led to greater use of prescription pain relievers.

In more explicit data, Ektorandersen et al. (1993) found that measured levels of chronic pain were greater in those geographical areas within the city of Malmo in Sweden that had higher local unemployment rates. Ruhm (2019) concluded that improvements in local macroeconomic conditions had small beneficial effects on drug deaths in the United States. Using a Japanese sample of approximately one million workers, Ikeda et al. (2019) produced cross-sectional evidence of an association between the unemployment rate in the geographical area and the regression-adjusted prevalence of lower back pain. Unusually, that study paid attention to issues of gender. It found that women in the sample appeared to be particularly sensitive to the local unemployment rate. More recently, innovative work by Wilkinson et al. (2020) showed, in longitudinal data from the National Survey of Midlife Development in the United States, by using linear lagged dependent variable models, an association between recession-era stressors and chronic pain 'interference' among 1,113 adults. In this case, the key survey question asked not about pain levels but about how pain had interfered with a person's life, and the principal explanatory variables were different kinds of experiences during recessionary times.

Issues of causality have been taken up more explicitly in Feyer et al (2000), who found that bouts of psychological distress seemed longitudinally to precede new bouts of back pain. A brain-science review article by Wiech and Tracey (2009) concluded that, although physical pain inevitably provokes feelings of anxiety and depression, there was also evidence for the existence of a reverse causal relationship. In other words, the authors suggested, negative

emotion itself can lead to new pain and exacerbate existing pain. The authors experimentally induced different mood changes and mood disorders, and discussed potential neural mechanisms. A further review by Linton (2000) concluded, consistently with these studies, that the available prospective research indicated that psychological variables were related to the later onset of pain. Rios (2011) found in a daily diary study that economic hardship was associated not only with greater exposure to daily financial worries but also with greater vulnerability to pain on days when daily financial worries were experienced. Using panel data from the National Survey of Midlife Development, Brown et al. (2018) estimated that 4.1 million people in the US aged over 40 had experienced chronic pain caused by increased psychological distress, where psychological stress was, in this case, due to perceived discrimination. Other empirical studies of pain, stress, and the potential role of economic factors include Schurer et al. (2014), Glei et al. (2020), and Janke et al. (2020).

Chou et al. (2016) has recently offered remarkable evidence. By using experimental-causal-chain and measurement-of-mediation approaches, the authors established that the feeling of lack of control generated a causal pathway from economic insecurity to physical pain. Meta-analyses in their study, testing the link from economic insecurity to physical pain, demonstrated that this link was empirically reliable. Overall, the authors' findings suggest in a new and arguably persuasive way that "it physically hurts to be economically insecure."

None of this previous work has examined links between pain and the state of the economy through time in large international samples.

METHODS

Data

We used data from the Gallup World Poll (GWP), a cross-sectional, nationally representative survey that contains data from more than 160 countries and 15 survey years

(2005-2018). Due to availability of our measures of interest the current study drew on data from 146 countries and 10 survey years (2009-2018).

Measures

Physical pain Our dependent variable was individual's physical pain. Respondents answered the following question *"Did you experience the following feelings during A LOT OF THE DAY yesterday? How about Physical Pain?"* with Yes (1) or No (0).

Unemployment rate (%) Our main independent variable was the unemployment rate, which denotes the percentage of unemployed people in a total labour force. People are considered unemployed if they do not work, and do not report to be engaged in other activities, such as study or in charge of housework. This measure was taken from the World Bank cross-country database (www.data.worldbank.org).

Control variables (demographic characteristics) In order to rule out alternative explanations, we added respondent's demographic characteristics that have been found to be associated with individual's well-being characteristics into our statistical models as control variables (see Di Tella et al., 2003 for a review). These variables included age (linear and squared), gender, level of education, employment status, respondent's income quintile, marital status, and number of children under 15 in the household. The measures were taken from the GWP. Tables with descriptive statistics and more details about these variables can be found in the Supplementary Materials (S.M).

Control variables (macroeconomic indicators) In our models, we also included macroeconomic indicators that are typically significantly associated with individuals' micro well-being characteristics and prosperity, namely the Gross Domestic Product per capita (GDP, in constant 2010 US$) and the inflation rate (Consumer Price Index, annual %). These measures were also retrieved from the World Bank database. Following prior research, and as

a check, we included GDP per capita lagged by one and two years in our models to explore the possibility of reverse causality (see Di Tella et al., 2003).

High-GDP and Low-GDP split We also explored whether the main findings of this paper held in high and low-GDP countries. This split was defined by using GDP per capita levels at the beginning of the period of analysis. At 2009, therefore, the nations were divided into a 'poorer' half and a 'richer' half.

Statistical analyses To explore respondents' physical pain in response to changes in the state of the economy, we used Ordinary Least Squares (OLS) to estimate linear probability models. Due to the bivariate (yes/no) nature of the dependent variable, however, we also checked our OLS models using binomial logit regressions. The two statistical methods yielded similar results (see S.M).

In all models, we included country and year fixed effects to account for unobserved country-specific and time-specific factors that could influence an individual's physical pain. We clustered the standard errors at the country-year level. This is to account for the different level of aggregation between the dependent variable, which is physical pain as measured for each individual, and the independent macroeconomic variables, as measured in each country in each year (Di Tella et al., 2003).

RESULTS

Formal regression-equation evidence is presented in Table 1. These are linear equations in which pain is viewed as depending on the state of the national economy, demographic factors such as age and gender, personal circumstances such as education and income, family circumstances such as marital status and the number of dependent children, and country and year influences as captured by country fixed effects and year fixed effects. Microeconometric equations can be found in Table A.1 in the Appendix.

As important background, 28% of people in the full Gallup sample report having had a lot of physical pain yesterday. Women tend to report noticeably higher levels of pain than men, and, as perhaps might be anticipated, the mean level of pain for both males and females rises steadily with age. Figure A.1 illustrates the basic patterns.

The mean unemployment rate in the countries over the period is 8%. Figure S.1 in the S.M depicts the changes in pain and unemployment over the main data period of 2009-2018. It reveals a rough positive association. To go further, and in order to choose the appropriate functional form of regression equations, it is necessary to recognize that economic recessions potentially affect physical pain through three channels – (i) the pain of individuals who become unemployed, (ii) the pain of those who manage to keep their jobs in a downturn, and (iii) the pain of people who are not in the workforce. An analytical method is required that permits the incorporation, and ideally the empirical separation, of these potential pathways. This paper estimates linear regression equations in which separate dummy variables are included for the three broadly defined employment statuses of (i), (ii), and (iii). One consequence will be that any remaining effects from, for example, the national unemployment rate will capture effects on pain that go beyond those from an individual's own employment status (that is, whether that person is unemployed, working, or not wanting or looking for work).

In Table 1 the dependent variable necessarily measures physical pain as a one-zero. The independent variables in these linear probability models include macroeconomic covariates for the unemployment rate in the country, GDP per capita, and the inflation rate, together with a number of micro-level covariates to adjust for the person's gender, age, employment status, income quintile, education, marital status, and the number of children in the household. For brevity, Table 1 does not report every coefficient. However, the full ordinary-least-squares specification can be found in the S.M. Many other checks were done. The S.M also gives equivalent results, using other kinds of estimating equations, including binomial logits. These

are in Tables S.4-S.19. Background descriptive statistics for the sample are given in Tables S.1-S.3.

Table 1 uses two main economic indicators -- the unemployment rate and the change in GDP. Both are statistically significant at the 5% level, although in later results the significance of GDP is not always maintained. The coefficient on the unemployment rate will be our principal focus. In Table 1 it varies in size across the columns from 0.002, $p = .027$; 95% CI [0.0002, 0.004] (column 1) to 0.004, $p < .001$; 95% CI [0.002, 0.005] (column 5). If 0.003 is taken as a representative effect-size estimate, the implication is that an extra 3 percentage points of unemployment is associated with just under a 1 percentage point rise in the numbers of citizens in pain. [The current study will not emphasize the possible role played by the level of GDP; to estimate the very long-run consequences of GDP in a truly persuasive way would require a longer time-span.]

To put the size of that extra-pain estimate in perspective, consider a medium-size rich country such as the United Kingdom (population 65 million). On Table 1's estimates, a rise of one million extra people being jobless, which is approximately a 3 percentage point rise in unemployment from the UK mean, would be associated with *an extra half a million people* reporting a lot of physical pain.

This finding has one notable aspect. It holds after adjusting for those additional individuals who themselves join the ranks of the unemployed in a recession. Therefore, the extra half million adults in pain are not the jobless. The measured rise in national pain here should instead be thought of as a kind of multiplied external consequence of recession -- a spread of pain that extends beyond those made literally jobless and is detectable in the pain levels felt by other adults who were not. To our knowledge, this kind of finding has not been reported before in the research literature.

As can be seen in Table 1, the change in GDP per capita does typically play a role in a physical-pain equation. Perhaps the simplest representative specification is that in column 3. Pain in any given year is raised by the unemployment rate, $b = .002$; $p < .001$; 95% CI [0.001, 0.004]; it is reduced by annual economic growth in that year, $b = -.038$; $p = .009$; 95% CI [-0.067, -0.009]. Statistical information is thus being garnered from both cyclical variables. Dropping the latter variable, as in column 5, produces a simple reduced-form estimate of the unemployment coefficient.

Tables 2 and 3 divide the sample into rich and poor nations, defined by their GDP at the starting year of 2009, and reveals a difference between the two halves of the world. The estimated pain response is far stronger in the high-GDP countries, $b = .003$; $p = .001$; 95% CI [0.001, 0.004] (Table 2, column 1). It is in a formal sense estimated to be negligible in poorer nations, $b = -.003$; $p = .186$; 95% CI [-0.007, 0.001] (Table 3, column 1). The positive coefficient on inflation in Table 2, for the richer nations, may signify that citizens also worry about a high rate of inflation in their country.

However, there is a caveat here. We are conscious that a variable like the unemployment rate is not easy to measure in a clear way in a low-GDP nation. Hence there is likely to be much more measurement error in the macroeconomic variables in the 73 low-GDP countries, which would lead to attenuation bias in coefficients. The standard-error bands in Table 3 are also large. The key results in this paper are to be thought of as applying most reliably to the richer nations.

A central scientific question remains to be addressed. Who are the individuals who suffer extra physical pain as a concomitant of economic recession?

Table 4 separates the data into subsamples. Those are males, females, older and younger adults, and citizens with high and low levels of education (defined as elementary education or less). A conspicuous result in Table 4 is the contrast between the unemployment coefficient in

the male, $b = .001$; $p = .302$; 95% CI [-0.001, 0.003] (column 1) and female $b = .004$; $p < .001$; 95% CI [0.003, 0.006] (column 2), equations. The difference between 0.001 and 0.004 is substantive and statistically significant (at the 99.9% confidence level on a chi-squared test). The numbers imply that women experience a far greater increase in physical pain during a downturn in the economy. It is not possible, in fact, to reject the null of zero on the male unemployment coefficient. However, the chance of Type II errors, and additional testing in the S.M, suggests to us that it may be unwise to assign a literal zero to the pain effect among men.

Table 4 also makes clear that the effect of national unemployment is strong even among those older than age 60. This result seems notable, and perplexing, because in principle this group should be heavily sheltered (as most of these men and women are not in the labour force) from the consequences of a high rate of joblessness in the economy. Why older citizens report more pain during recessions is a puzzle that demands further research. A tentative possibility is that it may reflect empathic concern for family members.

As a referee has pointed out to us, if it is low-skill work that is most under threat in changing economic times, one could imagine that the psychological pain from economic worry, which this paper potentially highlights as a channel to physical pain, would be high for the low-education group. Table 4 shows that the unemployment coefficient is certainly statistically significant. Nevertheless, the same coefficient, 0.003, is found on the unemployment rate for the high-education subsample.

Additional testing was done. The use of logit, as an alternative estimation approach, makes relatively little difference to the paper's conclusions (see the S.M for large numbers of alternative tables). Also, if life-satisfaction equations are estimated, they have a similar structure (with the signs reversed) to those in Tables 1-4, which again suggests, at least potentially, that physical pain may be a side marker of mental distress.

Further Checks

After suggestions from four referees, we implemented a variety of extra checks and robustness tests. In the S.M, results are provided showing what happens when

- GDP movements are allowed to have different effects up and down in the manner of De Neve et al. (2018) *(Tables S.20 and S.21)*
- An extra independent variable is entered capturing how comfortably people feel they are living on their income *(Table S.22 and S.23)*
- Extra independent variables are entered capturing people's feelings of job insecurity, general worry, health concerns, and satisfaction with life *(Table S.23)*
- The main regressions are re-run separately for the unemployed subsample and the employed+not-in-the-labor-force subsample *(Table S.24)*
- The main regressions are re-run incorporating also country-specific time trends and one-zero dummy variables that test for asymmetric effects for booms and recessions *(Table S.25)*
- The main regression result is checked for an extended period beginning from 2005, although here it should be noted that it is not feasible, because of the way Gallup designed the early surveys, to include a full set of individual covariates *(Table S.26)*.
- Other specifications and checks, including into the robustness of the unemployment effect, are given in tables S.27 to S.29.

These extra findings seem of interest. There are signs of asymmetry in the GDP effect; variables for people's feelings about income, worries, insecurities etc do enter statistically significantly; strong effects from national unemployment are detectable in the employed+not-in-the-labor-force subsample; there is robustness to the inclusion of country-specific time trends and of asymmetric variables for economic upswings and downswings; the key unemployment result goes through for an extended data set (although, for data reasons, with

only a restricted number of covariate controls in the equation) beginning in the year 2005, which pre-dated the upheavals generated by the infamous financial crisis of 2008.

Overall, in each of these different kinds of checks, the principal result of the paper continues to hold. Physical pain moves with the national unemployment rate in an anti-cyclical way.

DISCUSSION

The state of the economy is known to have important effects on citizens' incomes and happiness (Di Tella et al., 2001). This study pursues a different inquiry. It documents cross-national evidence that levels of physical pain increase during an economic slowdown and decrease in a boom period. When the unemployment rate is high, the level of felt pain in society is high. The estimated effect-sizes are substantial and are most pronounced in richer countries. Women suffer almost all the extra pain in a recession. These findings are new ones. We are not able in this paper to offer complete explanations for them.

As an empirical backdrop, we have in this study an economic period that was triggered by what might be viewed as the exogenous shock of the 2007/8 crisis. To get the necessary statistical power, the current study exploits the different cyclical circumstances of nations within our cross-national sample. In effect, the analysis constructs and uses panel data on countries. The paper's explanatory power comes ultimately from fixed-effects methods.

Limitations

One potential criticism of the current study might be that the main data used cover a single 10-year period in which the world economy begins in crisis (for a valuable discussion of the possible difficulties, see Ruhm, 2015). However, the span of data covers both parts of the economic cycle, and the data set offers a diverse spread of economic experience across countries. Moreover, the key result goes through, as Table S.26 shows, for a longer span that starts in the year 2005.

It should be acknowledged that the analysis draws upon a particularly simple measure of pain (the only one in the data set). That may be a limitation, because its one-zero character means that it is not possible to draw detailed conclusions about the severity of pain of any individual. An additional natural concern is that humans might exaggerate their physical pain during a recession – that their reported level of pain, in other words, is not real. In order to garner sick-leave permission from doctors, there is a chance that some working individuals may do this consciously in hard times. It is not easy, however, to view that kind of conceptual account as a full explanation for the current study's findings. There seems little reason for citizens to exaggerate pain to an independent survey team; the extent of any such dissimulation would have to be enormous in order to fit the empirical patterns; and it is not clear how this style of explanation would produce the different Table 4 results on, for example, females and over-60s. Nevertheless, as with all data on human feelings, scientific caution remains appropriate.

CONCLUSIONS

This study examines cross-national evidence on links between the level of physical pain in a society and the state of the economy. Pain is high when the unemployment rate is high. That is not because of greater pain among people who lose their jobs -- it extends far beyond that into wider society. The increase in physical pain is found predominantly among women.

One feasible, and perhaps plausible, way to account for this paper's patterns is that there is a link between mental stress and physical pain. Human beings who are anxious and under psychological strain may be intrinsically tense, and susceptible to illness, and thus for two reasons they might report (and feel) greater physical pain. Such a causal channel might also, in principle, be relevant to aspects of the US opioid crisis (Case & Deaton, 2020; Cherlin, 2018; Garland et al., 2013; Graham, 2017; Krueger, 2017).

There is existing scientific precedent for such a pathway of influence -- as recently put forward, using very different styles of empirical support than provided in the current paper, by researchers such as Katja Wiech and Irene Tracey (Wiech & Tracey, 2009) and Eileen Chou and colleagues (Chou et al., 2016; see also Yang & Haldeman, 2020). Such an account might also be consistent with modern evidence that worries about poverty can impair human cognition (Mani et al., 2013).

Why women are so deeply affected by physical pain in recessions is a fundamental and pressing question. Potential explanations for this study's findings include potential roles, in harsh economic times, for increased domestic abuse and violence, greater exploitation of vulnerable kinds of employees, physical injuries resulting from criminal activity, and physiological effects from the consumption of cheaper and less healthy kinds of food. Future research may be able to explore whether there is evidence for such pathways.

It may be, as suggested by the mental-load literature, that women do more of the planning in the household (Daminger, 2019). Women are more likely to be responsible for financial related tasks that emerge in periods of financial strain experiencing higher levels of emotional distress (Thorne, 2010). During recessions, women tend to experience high work demands (Novo et al., 2001), have little decision authority at work (Theorell et al., 2014), lack control over their work situation (Novo et al., 2001), and be more pessimistic about the future (Hammarström et al., 1988). Perhaps these factors somehow translate, in periods of severe economic conditions, into systematically greater physical pain. Or perhaps there is some other kind of causal channel waiting to be discovered. Given the practical, scientific, and cross-disciplinary importance of pain and of gender roles in modern society, these issues demand future scrutiny

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Data and materials availability: The Gallup World Poll data belong to Gallup, Inc. For more information, see:https://www.gallup.com/analytics/318875/global-research.aspx. Scripts for analyses are available through the Open Science Framework (OSF) https://osf.io/f2sh7/?view_only=5ea1be816de2497b8609d115f2b91b7b

Table 1: Physical pain and the business cycle in 146 countries, 2009-2018. Linear Probability Models.

	Dependent variable: Physical pain (1=Yes)				
	(1)	(2)	(3)	(4)	(5)
Unemployment rate	0.002*	0.002*	0.003***	0.002*	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
GDP per capita	-0.029***	-0.049**	-	-0.025**	-
	(0.009)	(0.017)		(0.009)	
GDP per capita (-1)	-	0.021	-	-	-
		(0.023)			
GDP per capita (-2)	-	0.003	-	-	-
		(0.014)			
Δ GDP per capita	-	-	-0.038**	-0.025	-
			(0.015)	(0.015)	
Inflation rate	0.004	0.001	0.004	0.001	-
	(0.011)	(0.011)	(0.011)	(0.011)	
Personal characteristics	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Constant	0.120***	0.118***	0.114***	0.153***	0.117***
	(0.013)	(0.014)	(0.013)	(0.013)	(0.013)
N	1,302,851	1,302,851	1,302,851	1,302,851	1,350,985

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Models show unstandardized OLS coefficients, with standard errors clustered by country-year in parentheses. The table depicts five regression equations, each to be read vertically.

GDP is scaled by a factor of 10,000 and inflation rate by a factor of 100.

Personal characteristics: Gender, age, age squared, employment status, income quintile, level of education, marital status, number of children in the household. The complete specification, with all variables' coefficients, can be seen in Table S.4 in the S.M.

Mean physical pain = 0.29.

Wording of the pain question: *Did you experience the following … during A LOT OF THE DAY yesterday? How about … Physical Pain? Yes/no.*

Table 2: Physical pain and the business cycle in 73 high-GDP countries, 2009-2018. Linear Probability Models.

	Dependent variable: Physical pain (1=Yes)				
	(1)	(2)	(3)	(4)	(5)
Unemployment rate	0.003***	0.003***	0.002**	0.003***	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
GDP per capita	0.008	-0.004	-	0.011	-
	(0.008)	(0.016)		(0.008)	
GDP per capita (-1)	-	0.011	-	-	-
		(0.024)			
GDP per capita (-2)	-	0.005	-	-	-
		(0.015)			
Δ GDP per capita	-	-	-0.013	-0.018	-
			(0.015)	(0.016)	
Inflation rate	0.025***	0.024**	0.022**	0.024**	-
	(0.007)	(0.008)	(0.007)	(0.008)	
Personal characteristics	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Constant	0.176***	0.170***	0.194***	0.172***	0.176***
	(0.031)	(0.031)	(0.025)	(0.031)	(0.026)
N	670,746	670,746	670,746	670,746	676,718

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.
Models show unstandardized OLS coefficients, with standard errors clustered by country-year in parentheses.
GDP is scaled by a factor of 10,000 and inflation rate by a factor of 100.
High-GDP per capita countries were defined as those in the upper half of our sample in 2009.
Personal characteristics: Gender, age, age squared, employment status, income quintile, level of education, marital status, number of children in the household.
Mean physical pain = 0.27.
Wording of the pain question: *Did you experience the following … during A LOT OF THE DAY yesterday? How about … Physical Pain? Yes/no.*

Table 3: Physical pain and the business cycle in 73 low-GDP countries, 2009-2018. Linear Probability Models.

	Dependent variable: Physical pain (1=Yes)				
	(1)	(2)	(3)	(4)	(5)
Unemployment rate	-0.003	-0.002	-0.002	-0.002	-0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
GDP per capita	-0.067	0.157	-	-0.075*	-
	(0.034)	(0.127)		(0.035)	
GDP per capita (-1)	-	-0.152	-	-	-
		(0.186)			
GDP per capita (-2)	-	-0.083	-	-	-
		(0.121)			
Δ GDP per capita	-	-	0.191	0.236	-
			(0.124)	(0.126)	
Inflation rate	-0.022	-0.008	-0.008	-0.008	-
	(0.042)	(0.042)	(0.043)	(0.042)	
Personal characteristics	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Constant	0.253***	0.252***	0.230***	0.252***	0.144***
	(0.019)	(0.019)	(0.016)	(0.019)	(0.014)
N	632,105	632,105	632,105	632,105	670,289

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.
Models show unstandardized OLS coefficients, with standard errors clustered by country-year in parentheses.
GDP is scaled by a factor of 10,000 and inflation rate by a factor of 100.
Low-GDP per capita countries were defined as those in the lower half of our sample in 2009.
Personal characteristics: Gender, age, age squared, employment status, income quintile, level of education, marital status, number of children in the household.
Mean physical pain = 0.32.
Wording of the pain question: *Did you experience the following … during A LOT OF THE DAY yesterday? How about … Physical Pain? Yes/no.*

Table 4: Subsample Results: Physical pain and the business cycle in 73 high-GDP countries, 2009-2018. Linear Probability Models.

	Dependent variable: Physical pain (1=Yes)					
	Men	Women	< 60 years old	> 60 years old	Low education	High education
Unemployment rate	0.001	0.004***	0.003***	0.003*	0.003**	0.003**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
GDP per capita	-0.001	0.023*	0.009	0.039*	0.035*	0.014
	(0.008)	(0.011)	(0.009)	(0.016)	(0.017)	(0.010)
Δ GDP per capita	0.007	-0.035	-0.014	-0.074**	-0.080*	-0.016
	(0.013)	(0.023)	(0.016)	(0.027)	(0.034)	(0.017)
Inflation rate	0.024**	0.024*	0.011	0.072***	0.027*	0.021*
	(0.008)	(0.009)	(0.009)	(0.014)	(0.013)	(0.009)
Personal characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.207***	0.073*	0.141***	-0.433***	0.055	0.087**
	0.032	0.035	(0.030)	0.116	0.046	(0.030)
N	305,247	365,499	497,591	159,861	118,766	390,376

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Models show unstandardized OLS coefficients, with standard errors clustered by country-year in parentheses.

GDP is scaled by a factor of 10,000 and inflation rate by a factor of 100.

Personal characteristics: Gender, age, age squared, employment status, income quintile, level of education, marital status, number of children in the household.

Mean physical pain = 0.27.

Wording of the pain question: *Did you experience the following … during A LOT OF THE DAY yesterday? How about … Physical Pain? Yes/no.*

Appendix

Table A.1: Physical pain and demographic characteristics in 146 countries before the inclusion of macroeconomic variables, 2009-2018. Linear Probability Models.

	Dependent variable: Physical pain (1=Yes)		
	Full sample	High-GDP countries	Low-GDP countries
Male	-0.036***	-0.037***	-0.035***
	(0.001)	(0.001)	(0.001)
Age	0.007***	0.008***	0.006***
	(0.000)	(0.000)	(0.000)
Age squared	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)
Employment Status *(Ref.: Employed full-time for an employer)*			
Employed full-time for self	0.009***	0.013***	-0.002
	(0.001)	(0.002)	(0.002)
Employed part-time want full-time	0.026***	0.041***	0.008***
	(0.002)	(0.003)	(0.002)
Employed part-time do not want full-time	0.016***	0.019***	0.005*
	(0.002)	(0.002)	(0.002)
Unemployed	0.013***	0.018***	0.001
	(0.002)	(0.003)	(0.003)
Out of workforce	0.021***	0.043***	-0.004*
	(0.001)	(0.001)	(0.002)
Personal income quintiles *(Ref.: Bottom 20%)*			
Second 20%	-0.024***	-0.018***	-0.029***
	(0.001)	(0.002)	(0.002)
Third 20%	-0.045***	-0.038***	-0.049***
	(0.001)	(0.002)	(0.002)
Fourth 20%	-0.063***	-0.059***	-0.063***
	(0.001)	(0.002)	(0.002)
Top 20%	-0.087***	-0.085***	-0.089***
	(0.001)	(0.002)	(0.002)
Level of education *(Ref.: Elementary)*			
Secondary	-0.096***	-0.101***	-0.084***
	(0.001)	(0.002)	(0.002)
Tertiary	-0.056***	-0.061***	-0.051***
	(0.001)	(0.002)	(0.001)
Marital status *(Ref.: Single/never married)*			
Domestic partner	0.012***	0.014***	0.013***
	(0.002)	(0.003)	(0.003)

Married	-0.006***	-0.013***	0.007***
	(0.001)	(0.002)	(0.002)
Separated	0.026***	0.026***	0.029***
	(0.003)	(0.004)	(0.004)
Divorced	0.022***	0.018***	0.033***
	(0.002)	(0.003)	(0.004)
Widowed	0.067***	0.061***	0.077***
	(0.002)	(0.003)	(0.003)
Children under 15 in the household	-0.002***	-0.004***	-0.001**
	(0.000)	(0.001)	(0.000)
Country fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Constant	0.124***	0.201***	0.142***
	(0.005)	(0.007)	(0.006)
N	1,350,985	676,718	670,289

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Models show unstandardized OLS coefficients with standard errors in parentheses. The table depicts three regression equations, each to be read vertically.

Wording of the pain question: *Did you experience the following … during A LOT OF THE DAY yesterday? How about … Physical Pain? Yes/no.*

Figure A.1: Physical pain and age by gender in 146 countries, 2009-2018. Correlation in raw data. *Men:* b = 0.003, s.e = 0.00003, t= 93.83, p = < .001**.** Intercept = 0.16, s.e = 0.001, t = 120.11, p < .001. *Women:* b = 0.004, s.e = 0.0003, t= 151.8, p < .001**.** Intercept = 0.01, s.e = 0.003, t = 108.4, p < .001. These are simple plots of the raw means in the data set. However, upward slopes in age continue to hold in full regression-adjusted plots.