The Aggregate Effects of Public Holidays*

Lucas Rosso† Rodrigo Wagner‡

This version: November 2025
[latest version]

Abstract

This paper studies the aggregate effect of a marginal working day. It introduces a novel dataset of public holidays for over 200 countries since year 2000. As a source of exogenous variation, we exploit changes in working days due to public holidays falling on weekends. Yearly working days present a within-country range of 1.9 percent (approximately 5 days). Using this variation, we estimate an elasticity of output growth to transitory changes in legal working days of 0.17, robust across multiple specifications and heterogeneous across sectors, with larger effects on manufacturing and no significant impact on agriculture. We also find that holidays are associated to fewer work-related deaths and to increases in short-run happiness.

***JEL classification**:* E32, E23, O40.
Key words: Public holidays, labor-leisure choices, labor regulation.

*We are grateful to Samuel Pienknagura, Andrea Repetto, Juan-Pablo Medina, Rodrigo Valdes, Eduardo Engel, Ernesto Pastén, and Bernabé Lopez-Martin for valuable suggestions. We also thank seminar participants at the Royal Economic Society, Sociedad de Economía de Chile, PUC-Chile, and Universidad Adolfo Ibañez. At different stages of the project, we benefited from the valuable help of Fernanda Castillo, Sergio Araya-Ramos, and Tomás Cortés. Usual disclaimers apply. The panel dataset with the time-varying instrument of extra working days is available at www.rodrigowagner.com.

†Columbia University. Email: lr3174@columbia.edu

‡Business School, Universidad Adolfo Ibañez. Email: rodrigo_wagner@post.harvard.edu

1 Introduction

In June 2025, ahead of the Juneteenth holiday, the United States President complained that the country had too many non-working holidays, warning that they were costing our country billions of dollars. While such remarks are often politically charged, they raise an important empirical question: what are the aggregate economic costs of public holidays? For a $30 trillion economy like the United States, the proportional GDP of a single business day is roughly $100 billion—yet the economic literature provides little causal evidence on this margin. At the same time, holidays are widely popular and stimulate activity in sectors such as tourism. In addition, some countries, such as Iceland, have recently experimented with a four-day workweek, motivated by potential gains in well-being. In this context, our paper exploits calendar-induced variation in the timing of public holidays across countries to estimate their aggregate effects on economic activity.

The allocation of time between paid work and leisure has a long tradition in Economics. In 1931, J. M. Keynes argued that the grandchildren of his generation would work only fifteen hours per week. But despite massive productivity gains during the last century, we are far away from working what Keynes predicted. In practice, labor-leisure decisions are, to a large extent, a social coordination problem, typically regulated by collective decisions (e.g., at the firm or trade-union level). At the extensive margin (i.e., official working days), governments tend to be the main regulators, defining special days out of formal work for large shares of the employed population (Botero, Djankov, Porta, Lopez-De-Silanes and Shleifer, 2004). In that context, there has been a growing debate on the cost of public holidays, in terms of output, government revenues, and sectoral implications, among others.

Therefore, in this paper, we propose a way to measure the aggregate costs of public holidays. We do so by exploiting exogenous variation on the day of the week a specific holiday takes place. In particular, many public holidays are tied to a *date* (e.g., New Year's Day in the US or July 14th in France), and so they often take place on weekends, generating an additional working day in that year. This allows us to identify the cost of one additional holiday on outcomes like aggregate output, sectoral production, and subjective well-being, among others.[1]

Public holidays reduce working days but can have multiple potential benefits. Politically, they tend to be popular, and some countries use them to build cohesion on some focal aspects of a nation's history.[2] Holidays may even have some advantages besides leisure. For instance, they may reduce stress if they share the proven properties of weekends (Kunz-Ebrecht et al., 2004; Schlotz et al., 2004; Thorn et al., 2006; Fritz et al., 2010; Ragsdale et al., 2011; Weigelt et al., 2019). Importantly, given fixed costs like daily commute, it is not obvious that a reduction in an average workweek should take place by reducing a few minutes every day.[3] Instead, countries could sometimes prefer having an extra holiday once in a while. For a social planner, the choice of holidays would need to solve the trade-off between the various social benefits and the costs

[1] We do not study the regular holidays that happen on weekends. Our holidays of interest are also different from the regulated number of days in which workers can take days off work (paid annual leave). Here, we focus on what is usually regulated as a holiday for a specific date for all those under a standard contract in a country.

[2] Anand et al. (2011) find that citizens tend to be happier on holidays.

[3] For a larger and regular example, Hamermesh and Biddle (2022) report an increase in the share of workers having "de facto" four-day workweek in the US, Germany, The Netherlands, and Korea. They argue this adjustment is due to either a preference to concentrate on a few days or daily fixed costs faced by either firms or workers (e.g., daily commute).

of holidays, chiefly the potential net loss of market production.[4,5]

Our paper contributes by measuring the effect of legal working days on economic growth using a novel identification, based on a calendar year-to-year variation in these holidays, which is arguably orthogonal to confounding determinants of growth, like income effects, which impact aggregate work hours (see Bick, Fuchs-Schündeln and Lagakos, 2018). For that purpose, we first present a new country *panel* of public holidays, spanning two decades (2000-2019) and over 200 countries. This means we add the time-varying dimension to existing holiday databases that only had cross-sectional variations.[6]

The effects of working days or public holidays on growth are far from obvious, both in theory and in the empirics. In theory, besides income effects, the aggregate holiday effect on GDP should take into account that some components of GDP may even rise during a holiday, like private consumption (e.g. Ramasamy et al., 2008). There could also be anticipation effects. Moreover, different sub-components of labor (employment, days worked, average hours per day, etc) may enter the aggregate production function differently (e.g. Feldstein, 1967).

[4]A recent example of a transitory holiday is the death of Queen Elizabeth II. The Guardian (Sep 2022) reported that Australian business groups argued a cost for the economy of $ 1.5 billion for this transitory holiday. For the 1.5 trillion Australian economy, that is not far from our estimate of 0.1 percent of GDP per day.

[5]The New York Times reported (June 16, 2021) that Senator Ron Johnson "*had raised concerns about the estimated $600 million cost of providing another paid holiday for federal employees and suggested ending an existing national holiday to make room for the new one. His move gained no traction, and he eventually relented*". But those 600 million would be a federal budget's cost, not foregone GDP. Using our elasticity - estimated with global data and transitory holidays - would imply ≈0.1 percent of US GDP (i.e., around $ 25 billion). That is roughly forty times larger than the federal fiscal figure reported in the NY Times article above. While the US may have a lower elasticity, let's also note that this was a discussion of a permanent holiday, so the effect on GDP could be even larger if it kicks in lower capital stock. Naturally, our point is simply about the estimation of the economic cost coming from having a new holiday rather than replacing the holiday with an existing one. Of course, it does not constitute a cost-benefit analysis, and holidays have many benefits, both tangible and intangible, that could far outweigh these costs.

[6]Other databases like the GGDC Total Economy Database and OECD (see Boppart and Krusell, 2020) have total working hours in a long time series for a group of around 31 countries. But they do not separate holidays from other sources of variation in work hours. On the other hand, they are purely cross-sectional data on holidays. For example, Botero et al. (2004) does not allow us to separate our question of interest from the country-level determinants of growth and holidays. Such an analysis is based on the average number of holidays or the number of holidays in a given year.

On the pure measurement side, the construction of macroeconomic time series tend to have seasonal adjustments, so it is theoretically ambiguous to sign the additional effects of a holiday in this adjusted data. Relevant for our purposes, though, while the IMF *Quarterly* National Accounts Manual (chapter 7) mandates that these "*calendar effects should be removed from the series*", the most important year-to-year statistics do not have this correction. We use this yearly GDP data, which is the most widely used and meaningful statistic, to identify the effect of holidays on growth.

Econometric challenges also complicate getting the magnitudes and signs right. The number of working days is an endogenous choice made by countries, generating a crucial identification challenge. Consider, for instance, the case of countries that improve their unobserved productivity driver, and consequently increase their holidays due to income effects. That was Keynes' grandchildren's story. In those cases, the naively estimated GDP elasticity of working days from a bi-variate time-series regression would be *negative*, which is certainly the opposite of a proper way to measure the opportunity cost of public holidays. Applying such a negative labor-to-GDP coefficient to our question would wrongly suggest that holidays more than pay for themselves, which is not the case. This bias is far from a purely theoretical possibility. In fact, our data confirms that as countries get richer, they add more public holidays, on average. A negative relation between (permanent) working hours and economic activity has already been documented in the international macro data (Jones and Klenow, 2016; Boppart and Krusell, 2020; Bick, Fuchs-Schündeln and Lagakos, 2018).[7] As a preliminary contribution,

[7]For a discussion on the permanent changes a la Boppart and Krusell (2020) and Bick et al. (2018), see Section 3.5. Going beyond GDP, Jones and Klenow (2016) finds that European countries like the UK, Spain, Italy, and France tend to have around 25 percent higher welfare (as consumption equivalent) than what one would expect given their GDP difference with the US. An accounting exercise suggests that 8 points of that difference is because these European countries have fewer working hours per person (not per worker) vis-á-vis the US.

we extend the result and present an (inverse) income elasticity in the long run. But instead of aggregate hours worked, we use *changes* over two decades in our new database of a single component behind aggregate labor, namely the number of public holidays per year and the implied working days. These long-run results are coherent with estimates in the above literature (see Figure 4 and Section 3.5). Crucially, though, this long-run variation does not address the opportunity costs of holidays, which is the central focus of this paper.

Our contribution comes from exploiting the year-to-year changes in regulated working days to identify the elasticity of output growth to changes in official working days.[8] In particular, we exploit that in many countries, some special holidays may temporarily fall on a standard weekend, instead of the usual weekday, therefore generating a mechanical increase in working days that year. This is due to predetermined calendar reasons, which are arguably orthogonal to changes in productivity or other unobserved confounders of our elasticity of interest. Importantly, there is a meaningful year-to-year variation that allows for estimating the effect. For the average country in our sample, this mechanism induces a range of around five working days for different years of the same country, which is a 2 percent change in official working days. As a current benchmark Aksoy et al. (2023) find that the time savings due to working from home are also around 2 percent for the average worker.

On our baseline estimation, we find that working days impact GDP growth with an elasticity of around 0.17. This elasticity implies large and economically meaningful effects when

[8]In most of the macroeconomic literature, labor supply is considered an endogenous variable optimally chosen by households given other frictions (e.g., taxes). Instead, like Botero et al. (2004), here we look at a direct restriction of hours worked. One could argue that workers and firms may be able to undo the government policy by increasing labor supply during some other non-holiday days, reaching a privately optimal level of working hours in a year or month. In practice, some of this might happen when coordination costs are low or incentives are large. Nonetheless, our paper argues this is far from being the whole story since the regulated number of working days has a statistically significant effect, different from zero.

compared to other changes in short-run growth forecasts. For the average country, the range of five extra days induced by holidays falling on a weekend generates a 0.5 percentage point change in growth forecasts, which is around two-thirds of a typical revision of the IMF's World Economic Outlook (WEO). Our average coefficient could also matter for year-to-year variation. For example, based on our results, countries like Spain, Mexico, and Korea were expected to grow 0.2pp more in 2023 due to two additional working days, opposite to France, which had two additional public holidays relative to the previous year.

In addition, we find that this effect is heterogeneous across sectors, with larger effects concentrated in the industrial sector—namely mining, manufacturing, utilities, and construction—and no impact on agriculture. These results highlight that sectors differ in their exposure to fluctuations in effective working days, likely reflecting differences in production technologies, labor intensity, and the ability to substitute across time. For instance, industrial activities often rely on continuous, coordinated labor input and fixed capital utilization, making them more sensitive to interruptions in the working calendar. By contrast, agricultural output may depend more on seasonal cycles and weather patterns, rendering it less responsive to short-run changes in the number of working days. This heterogeneity is important for understanding the aggregate implications of holiday-related shocks and is informative on the cost of introducing new holidays across countries, depending on their sectoral composition.

We also show that one additional working day leads to a decline in self-reported happiness, although it does not affect overall life satisfaction. Further, we find that years with a higher number of working days are associated with an increase in deaths caused by unintentional and transport-related injuries, likely reflecting a rise in work-related accidents and commuting risks. These results point to a broader set of trade-offs associated with changes in the working calendar: beyond output, such changes have additional costs in terms of physical and mental well-being.

Literature review. Our work relates to Campante and Yanagizawa-Drott (2015a), in the sense that they also use calendar variation to explore how the duration of Ramadan fasting impacted economic growth, labor supply, and other perceptions of well-being. Unlike our approach, they focused on a religious activity that is *not* a labor market regulation and that only works for a small subgroup of countries in the world. Along the same lines, both Atkinson and Fowler (2014) and Montero and Yang (2022) explore the variation in religious festivities in Mexico to understand the effects on voting and economic activity, respectively. Using only religious festivities in a country bundles time off work with other aspects such as religiosity and social capital. In comparison to this literature, our approach is more precisely connected to a new average holiday. Our approach is also, of course, much broader in terms of geographical scope. Similarly, Georges-Kot et al. (2024) also uses calendar variation in public holidays to estimate preferences for leisure within the household in France. We use the same source of variation to calculate the aggregate cost (in terms of GDP) of an additional public holiday.

Regarding proper holidays, Bruno et al. (2006) looks for spillovers among European countries due to EU holidays. Importantly, they do so on a quarterly basis, looking mostly at effects that could in principle cancel out between quarters. They do not find a spillover effect of other countries' holidays on GDP.[9] The existing literature on holidays displays what is mostly a cross-section of public holidays across countries (Botero et al., 2004). On that margin, our

[9] Ramasamy et al. (2008) explore the effect of holidays on Hong Kong's quarterly GDP, but in a context of an increase in the number of working days.

paper contributes by offering a time-varying panel for a global sample of countries. Altonji et al. (2003) also offers a panel, but for annual leave or paid vacation, not public holidays. Section 5.4 shows that our results are robust to correct for changes in these paid annual leaves. Our work may also provide some benchmarks for the current debates of hybrid work schedules (e.g. Bloom et al., 2022) and the four-day workweek (e.g. Al-Ubaydli and List, 2022; Hamermesh and Biddle, 2022). For the last one, one should keep in mind that our identifying variation comes from transitory marginal shocks to working days, rather than more permanent and sizeable changes.[10]

Layout. The rest of the paper proceeds as follows. Section 2 offers a simple framework and explains our identification. Section 3 presents our data, descriptive statistics, and some stylized facts. Section 4 shows the results of our baseline estimations on the cost of a holiday. Section 5 studies the robustness of our baseline model. Section 6 explores potential channels for the effect and exploits different sources of heterogeneity in our data. Section 7 further exploits our identification strategy for other extensions. Finally, Section 8 concludes.

[10]Recent years have witnessed massive media and scholarly attention for new arrangements that impact labor-leisure allocations, namely Working from Home and some pilots on the so-called "4-day workweek". A recent European Commission's report has remarked on the various empirical challenges that complicate the interpretation of the few pilots involved in workweek reduction (Cuello, 2023), especially the tension between getting causal estimates and variation of aggregate economic interest, beyond specific cases. Along the same lines, Campbell (2023) reviews half a century of policies to reduce the workweek and argues for the need to understand causality in scalable settings. Importantly, in that debate, List (2023) argues that recent experimental pilots on the four-day workweek should not be directly extrapolated. Even if some of them could provide causal effects, they usually happen in small and selected samples that can tell very little about the effect in cases these pilots are massively scaled-up (see Al-Ubaydli and List, 2022), because of both reductions in the treatment effect as well as general equilibrium considerations, jointly labeled "*Voltage drop*" (List, 2023). While our study does not directly measure permanent changes in working time, it contributes to this literature by providing a causal benchmark of the aggregate effect on a country's economy.

2 Basic Framework and Source of Identification

Estimating the value of the marginal working day is empirically challenging. Households and firms make labor supply/demand decisions considering the current state of the economy, as well as their expectations for the future. Similarly, political authorities choose labor regulation, which could be related to aggregate variables and their evolution. To address these concerns about endogeneity, we propose a novel way to identify the output cost of a public holiday by looking at variations in countries' working days due to a public holiday ending up on a weekend day.[11] This section offers a simple framework that outlines our identification strategy, followed by some examples that clarify which sources of variation we exploit to get the aggregate output impact of the marginal working day.

2.1 Framework and Identification

We are interested in estimating the elasticity of aggregate output to an exogenous change in working days. In that context, let Y_t denote a country's output and assume it is a function of the number of official working days. Then, by taking log differences, we have that

$$d \log Y_t = \alpha_D d \log (\text{working days}_t) + \varepsilon_t, \tag{1}$$

where α_D denotes the elasticity of output to working days and ε_t is an error term that includes changes in capital stock, TFP, average hours worked, employment, and an occupational factor

[11] To the best of our knowledge, there is one paper that also exploits this source of variation but for a different purpose. Namely, Georges-Kot et al. (2024) study preferences for leisure synchronization within the household by using the same year-to-year variation in the number of *effective* public holidays.

(e.g., average annual leave or maternity leave).[12] Given that year-to-year changes in working days are due solely to public holidays falling on a weekend, our identifying assumption is that $\mathbb{E}[\varepsilon_t | d \log(\text{working days}_t)] = 0$. That is, changes in working days are unrelated to changes in employment, the average number of hours, the occupational factor, aggregate productivity, or firms' capital accumulation decisions. For some of these variables, we will be able to test this relation by using data from Penn World Table and Bick et al. (2019), while for others we will try to provide robustness exercises to the extent to which we have available data.

The assumption that year-to-year changes to working days do not have spillover effects throughout the labor market is, of course, questionable. However, we claim that changes due to an extra public holiday falling on a weekend do not increase firms' demand for labor along the *extensive* margin. We can also test this empirically by using employment data from PWT, where we find no effect (see Section 5.1). Moreover, if changes in working days affect *formal* employment, we should see shifts in *informal* employment. Combining our data on working days with panel data on the share of informal workers taken from the International Labor Organization (ILO), we test this hypothesis in Section 5.4, again finding no significant effects.

In addition to affecting employment, changes in annual public holidays could potentially

[12] A particular case of this is when the elasticity corresponds to the labor share, that is, when $\alpha_D = \alpha_L$. To see this, consider an economy with a single type of capital and labor, and a Cobb-Douglas technology $Y = (A_t L_t)^{\alpha_L} K_t^{\alpha_K}$, with $\alpha_L, \alpha_K \in (0,1)$ and $\alpha_L + \alpha_K \leq 1$. In this economy, total labor is given by

$$L_t = E_t \times \text{working days}_t \times h_t \times (1 - \phi_t),$$

where E_t denotes total employment, h_t average hours worked per day and $\phi_t \in (0,1)$ is some time-varying occupational factor. Then, we can express Equation (1) as

$$d \log Y_t = \alpha_L d \log(\text{working days}_t) + \varepsilon_t,$$

where $\varepsilon_t \equiv \alpha_L (d \log(E_t) + d \log(h_t) + d \log(1 - \phi_t) + d \log A_t) + \alpha_K d \log K_t$. Given that, in principle, the elasticity of substitution of labor components within L might not be one, we do not consider this as the benchmark framework and instead simply focus on estimating the elasticity of output to changes in working days.

affect labor market outcomes through the *intensive* margin. That would be the case if workers decide (or are required) to compensate for the extra holiday by working more daily hours on the rest of the working days. We can also test this relation for European countries and the US using data from Bick et al. (2019), where we do not find a significant relation. Further, it is common for labor regulations to impose caps on weekly working hours, additional payments for extra hours, and mandatory public holidays, restricting the way firms could compensate extra holidays by increasing labor during the rest of the week (see Botero et al., 2004). Similarly, these labor regulations prevent, to some extent, how changes in public holidays can affect the occupational factor, as firms in most sectors are typically prohibited to force workers to work on a public holiday.[13,14]

2.2 Outlining the Identification Strategy

A starting example. Let's start with a hands-on example. Figure 1 depicts the Chilean calendar for May 2016, 2017, and 2018, using gray to gray to denote weekends and using red numbers to point out public holidays. Notice that despite having two official holidays scheduled for May 2016 (panel A), both of them fell on a weekend. This implies that if the rest of the public holidays fall on weekend days, then the country will have two additional working days this year. If we fast-forward to May 2017 (panel B), we would see there was only one holiday falling on a weekend, with zero falling on a weekend by May 2018 (panel C). This is precisely the kind

[13] For example, in France, most sectors (with few exceptions such as hospitality and catering) prohibit work on public holidays. This translates into approximately an 80 percent of employees not working on public holidays (Georges-Kot et al., 2024).

[14] Furthermore, the fact that we do find a significant effect of an additional working days on output, even when firms and workers can fully anticipate this change, suggests that adjustment in the labor market to our source of variation is limited.

of variation we exploit for identification.

Figure 1: Illustration of the Source of Calendar Variation

(A) May 2016

						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

(B) May 2017

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

(C) May 2018

	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

Notes: This figure displays a calendar with the example of May 2016, May 2017, and May 2018 in Chile. Black numbers denote weekdays, gray numbers weekend days, and red numbers represent the two public holidays that take place on that month every year.

Calendar cycles interact with country-level dates. As stated, the central identification assumption is that the evolution of holidays that lie on a weekend is as good as random *vis-a-vis* the unobserved component. But of course, strict randomness is a convenient approximation. In reality, by reordering dates over weeks, one can get true cycles as the examples shown in Table 1. In fact, the calendar years follow a cycle of either 6 or 11 years to repeat the week structure of a year. As noted, this structure is irregular. Moreover, for leap years, this takes some 28 or 40 years to repeat itself. A number of features in our identification strategy suggest this might not be a challenge. First, the year-to-year variation that is equal across all countries is absorbed by the year fixed-effects (e.g., very frequent holidays, leap years, basic cycles). Second, in our 20-year sample, it seems unlikely that our results would be driven by such an irregular cycle. Third, and more important, is that this global cycle interacts with the country-specific structure of holidays. This makes it much safer to assume that the calendar variation is not correlated with unobserved shocks.

Table 1: Example of Calendar Cycle: Difference in Consecutive Years With Same Weekly Structure

Original year	2018	2019	2020
Cycle duration to year with same workweek			
Δ years before previous	-6	-11	-28
Δ years, previous	-11	-6	-28
Δ years, to next following	+11	+11	+28
Δ years, to second next following	+6	+11	+28

Notes: This table displays the number of years in between two years that share the same structure of weekdays. For example, the year 2018 has the same structure as the year 2007, eleven years before. That is why the -11 years. In the same way, year 2007 shares the weekday structure of year 2001, six years before, so the duration of the cycle before the previous event was -6 years (2007 minus 2001). An analogous procedures go to future years. For the leap year 2020, there is a 28-year difference in the cycle of having another year with the same structure of weekdays. Note 2020 is only used as an example of a leap year and does not belong to our baseline sample due to an arguably different data-generating process (i.e., COVID and lockdowns).

3 Data and Descriptive Statistics

This section describes our main data sources and presents descriptive statistics. We introduce our novel panel of yearly working days for the period 2000-2019, describe other sources of data we merge to this panel, and define the baseline sample we focus on during the empirical analysis. Then, we present simple summary statistics and graphically display two main trends. First, we look at the long-run run variation in public holidays and output, related to Keynes' quote. Namely, if leisure is a normal good, richer countries should have more public holidays (fewer working days). Second, we analyze the relation between "extra days" and growth in the short run, as it directly relates to our identification.

3.1 Data Sources Sample Selection

Public holidays. We collect data for calendar dates of national holidays for 222 countries during the two decades going from 2000 to 2019. [15] We then merge this data with real GDP time series and additional data on sectoral output, subjective well-being, and deaths by cause, among others.

Our first step was to collect public holidays online from timeanddate.com. This website contains information on holidays worldwide for 2000-2040, according to current regulations.[16] This allows us to extract for each country the exact date of the holiday, its day of the week, and a brief description of the characteristics of the holiday. Our source also classifies holidays into "public" or "not public" holidays. We use only public holidays. Crucially, we distinguish those public holidays that fall during an otherwise normal weekday from those that fall on a weekend. Movements in the number of holidays on weekdays/weekends allow us to create our measure of extra days.[17] Please note that our measure of extra days does not come from an optimal choice from individual agents but from a collectively chosen policy. For more detail on how we build our panel of holidays and working days, see Online Appendix A.[18]

[15] We have a complete panel for 141 of these 222 countries and with over a decade of data for 169 countries. We have missing values for approximately 20 percent of the potential observations in the 222 countries times 20 years, mainly due to limited coverage in the early 2000s. As we explain later, our baseline sample uses 166 countries, though this number can change depending on the dependent variable.

[16] At previous stages of this project, we have attempted to use other calendar sources, but they had much less coverage in terms of both years and countries. Our compiled data with time-varying yearly public holidays and the implied working days will be available online at www.rodrigowagner.com.

[17] It is well-known that in much of the western world, Sundays are weekend days, and in most cases, Saturdays have also become a weekend day, either totally or partially. Muslim countries and Israel follow different work-week and weekend patterns, but one could still distinguish the regular weekend from the rest. In the process of generating the data on yearly working days, we do, in fact, consider this cross-country variation in what days are considered working days/weekends.

[18] In addition, it is important to note that within-year changes in legislation made to incorporate holidays in lieu of holidays on weekends are not captured in our measure of extra days. Incorporating these features into the data might allow us to study the effect of these (probably unexpected) changes in legislation on GDP, as well political economy of how holidays are set. We see these questions as fruitful avenues for future research.

Other aggregate variables. For the remaining aggregate data, we use standard sources. First, the IMF's World Economic Outlook (WEO), October 2022 edition. In most cases, we use variables in local currency.[19] Second, we use Penn World Tables (PWT) to obtain data on the evolution of employment and capital stock. Third, we use UNCTAD data for GDP by productive sector. Fourth, for subjective well-being, we use survey data from the World Value Survey (WVS). Fifth, for health variables, we use data from the Global Burden of Disease (GBD). Table D.1 in Online Appendix D offers more details on specific variables and data sources.

Baseline sample. To build our baseline sample, we proceed as follows. Given holiday data availability, we use a cross-country panel covering years 2000-2019, excluding the post-COVID outbreak in 2020. We understand that the variation induced by the on-and-off dynamics of holidays could be a relevant component for normal times, but not for a once-in-a-century crisis and its rebound. We also trim growth data at the top/bottom 0.5 percent to exclude outliers typically related to political crises, wars, etc.[20] Our baseline also excluded six countries (China and Russia among them), where our data shows additional working days on weekends. This is aimed at reducing measurement error. Nonetheless, our main results do not depend on this selection criterion. In fact, we re-estimated all our main results, including these six countries and a procedure to correct the number of working days, getting very similar results.[21] Finally, we exclude countries with populations below 300 thousand in 2019. After merging growth data with the 222 countries, we have data on holidays, and applying the aforementioned criteria, we end up with a baseline sample has 166 countries. Note, however, that the country coverage

[19] As a robustness test, we estimate our baseline regression using Real GDP growth in US Dollars, using data from the World Bank's World Development Indicators (WDI).

[20] For example, we exclude several observations from Zimbabwe (hyperinflation), Iraq (war), among others.

[21] These results are available upon request.

might change for other outcome variables due to restrictions on the left-hand side variable.

3.2 Building Early Working Days from Public Holidays and Official Workweek Schedule

Our initial measure of potential working days is built as 52 weeks and 5-6 business days per week (depending on country-specific regulations). Notice that because weekend days may differ across countries (e.g., many Muslim countries consider Friday and Saturday as weekends), we generate a country-specific weekend and working week schedule. This is possible due to information contained in timeanddate.com which allows us to scrape the official business days for each country.

Using the items above, we define effective yearly working days as

$$\text{working days}_{ct} = 52 \times \text{workweek}_c - \sum_{j=1}^{J_{ct}} \mathbf{1}(\text{holiday}_{jct} \notin \text{weekend}_c), \tag{2}$$

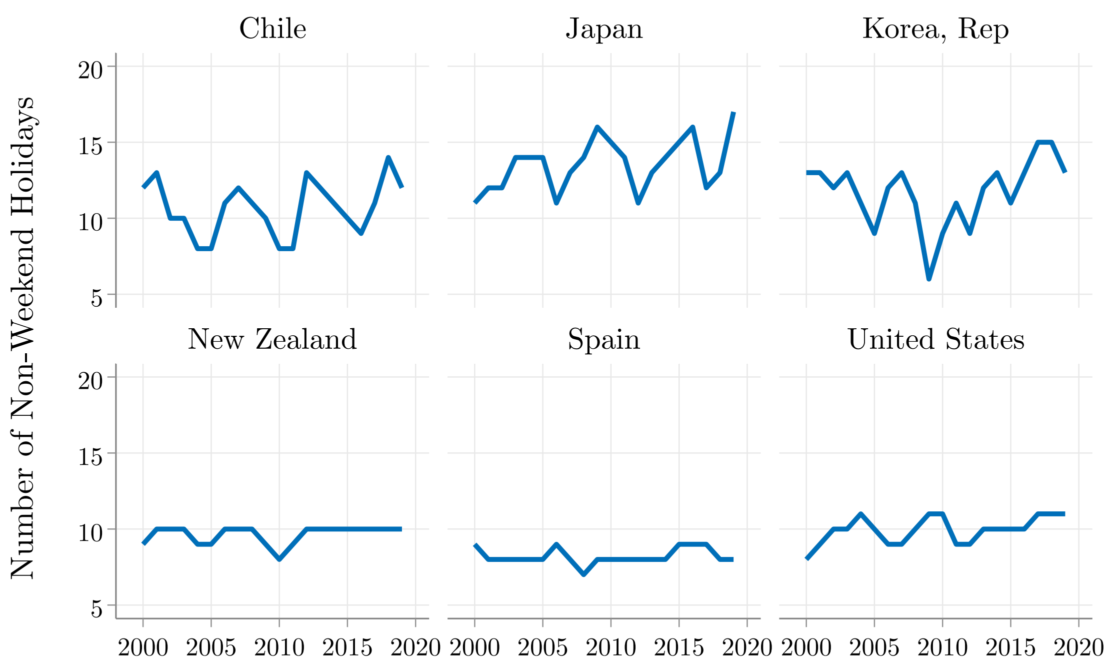
where workweek_c denotes the amount of business days per week of country c and $\mathbf{1}(\cdot)$ denotes an indicator function. In this case, the condition on the last term of Equation (2) is satisfied if the holiday j in the country c takes place on a business day.[22]

Figure 2 presents some examples of the total number of holidays *not-on-a-weekend*, for a sub-sample of six countries in our panel. Over the years and due to calendar effects, Chile moves between 8 and 14 effective holidays per year. In contrast, the US has a much narrower variation, between 8 and 11 non-weekend holidays per year. The lower volatility in the US

[22]In our data, we have a few "half-day" holidays (see Table A.1 in Online Appendix A) which we simply count as 0.5 working days less in that year.

time series is unsurprising, though, given the US Uniform Monday Holiday Act of 1968, which moved several federal holidays to Mondays. While Japan also had equivalent legislation, the so-called "Happy Monday System", the country still displays a relevant variation in effective non-weekend holidays, which range between 11 and 16 days per year. The apparent contradiction stems from the fact that only 3 out of 16 holidays are in this automatic regulation.

Figure 2: Number of Holidays not on a Weekend



Notes: Vertical axis reports the number (days) of holidays that do not end up scheduled on a weekend day. Non-weekend holidays only include official national holidays. For details on the eligibility criteria for holidays, see Online Appendix A.

3.3 How Volatile are Effective Holidays Within Countries?

To get a sense of the overall year-to-year variation within countries, Table 2 displays cross-country averages for standard deviations and ranges. On average, the number of national holidays that fall on a weekend has a range of 4.7 days in between years, which corresponds to a difference close to 1.5 percent between extreme years, within an average country. The standard deviation is, of course, lower (0.57 percent). That is precisely our source of identifying variation for this paper.

Table 2: Dispersion of Total Holidays and Working Days Within Countries

	Average across countries of	
	Std. Dev. within country	Range within country
log working days$_{ct}$	0.57%	1.85%
Sum of non-weekend holidays	1.45 days	4.66 days

Notes: All variables computed on a yearly basis for our baseline sample. Non-weekend holidays only include public holidays.

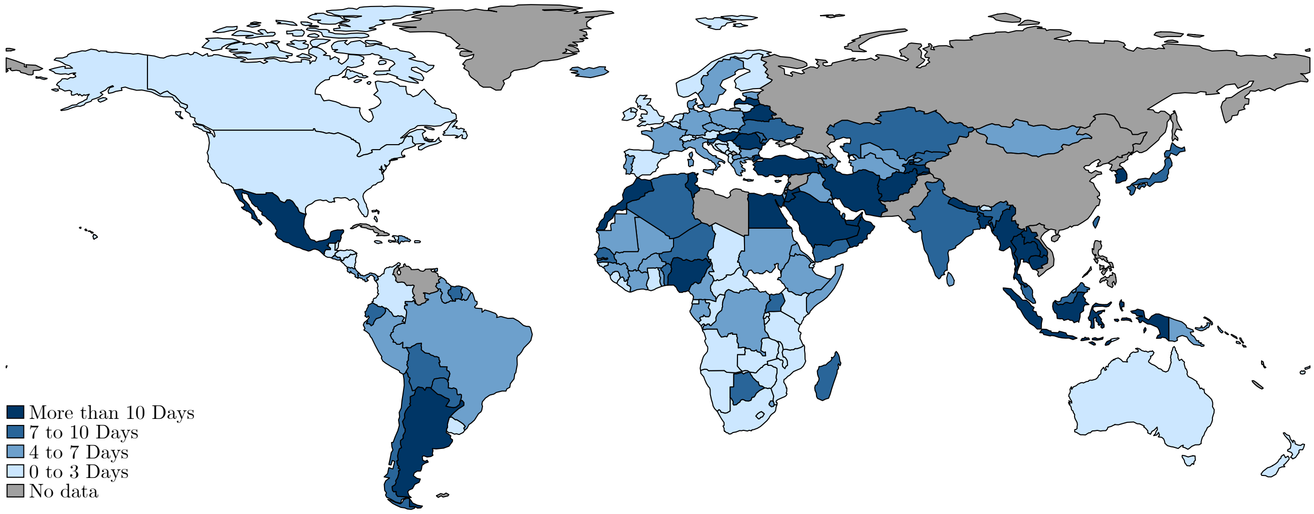
As a complement, Figure 3 displays a map of the ranges of working days within each country. The map suggests that some of the preferences or tolerance for holiday volatility might have some regional/geographic correlation. It is relatively high for Latin America and Asia, with some effect in Europe. On the other hand, the Commonwealth nations and the US display little year-to-year volatility. Overall, this preference for "volatile" holidays does not seem to be strongly related to income per capita in the cross-section.[23]

3.4 General Descriptive Statistics

Table 3 presents descriptive statistics of our data. National holidays have a sample average of 13 national holidays and 252 working days. The standard deviation of holidays across country-year observations is close to 4 days, with a standard deviation of 3.3 days on weekdays. Most countries have also increased their holidays over time. The average is roughly 1.5 days in

[23]Figure E.2 shows a slope between range and income of -0.07 (p-value 0.15).

Figure 3: Within-Country Range in Effective Working Days From Holidays Falling on Weekends



Notes: Range represents the difference between the maximum and minimum number of working days in a year for our sample period 2000-2019. This variable is computed following Equation (2).

two decades (see Figure E.1 in Online Appendix E). Importantly, we can measure meaningful compliance with calendar variation. On average, there is roughly one public holiday "in lieu" for every six holidays that end up on a weekend.[24]. These highlight the importance of holidays as a shifter of yearly working days.

Table 3: Summary Statistics

	Mean	Std. Dev.	Min	Max	Obs.
Working Days	251.99	10.24	235.00	310.00	3,076
Public Holidays	13.02	3.84	1.00	35.00	3,076
Weekend holidays	2.95	1.79	0.00	12.00	3,076
Workday holidays	10.08	3.31	0.00	31.00	3,076
In lieu holidays	0.53	1.12	0.00	7.00	3,076
Real GDP growth (%)	3.89	4.08	-27.67	26.40	3,587

Notes: This table presents summary statistics using our baseline sample. Holidays represent the number of national holidays, while working days are computed following equation (2). Data for Real GDP growth (local currency) and population (millions) from the IMF (WEO October 2022 edition).

[24]This does not include many cases like the ones in the US, where many holidays are officially set to move to the next Monday, or similar

3.5 Stylized Facts

This subsection presents descriptive empirical evidence of both long-run and short-run relationships between holidays and economic growth.

Long run: as countries become richer, they get more holidays

Recall that the center of our paper is to use short-run variation to escape from the long-run relationship between holidays and growth, mediated by factors like income effects, as in Keynes (1931). But first, it is reassuring to note that this long-run relationship holds in new data on holidays. Panel (A) in Figure 4 confirms that as countries get richer, they tend to increase public holidays. This is equivalent to a reduction in working days as a country develops. The plot's vertical axis shows the annualized GDP growth, while the horizontal axis displays holidays, also in terms of annualized growth during our 20-year sample period. We used a three-year average in each endpoint to avoid picking up short-run variation. The slope of the relationship (elasticity 0.21, SE $=$ 0.09) supports the view that national holidays are considered a normal good, which increases with income. Of course, one could see variation. For example, during these two decades, Argentina had a similar GDP growth to the US, but with a stronger expansion in effective public holidays.

To benchmark these long-term results, it is useful to invert the plot and compare it with the recent literature on how overall work hours per year depend on income per capita. Boppart and Krusell (2020, Appendix C8) estimate a bivariate panel elasticity of hours worked with respect to changes in country-level output per worker of -0.13. Along similar lines, Bick et al. (2018, Table 8) find a GDP elasticity of hours of -0.12. In that setting, a "naive" bivariate regression on the GDP cost of fewer hours worked could come from inverting this estimate, meaning an (inverse) elasticity between -7 and -8 ($\Delta \log Y / \Delta \log \text{hours}$). In the note of Figure 4, we have an equivalent estimate of approximately -11.8 (p-value < 0.01). This estimate is slightly larger than the literature mentioned in this same paragraph, though those previous estimates fall within its confidence intervals

As mentioned, our innovation above is that our time-varying data allows us to plot *differences* in holidays and income between countries, since previous studies measuring holidays did not have a panel. On the other hand, the previous datasets that did have a panel, like OECD or Total Economy Database (Bick et al., 2018), measured overall work hours per year rather than our focus, which is the portion coming from effective public holidays. Importantly, the long-run dynamics we document are also coherent with Jones and Klenow (2016), who find that countries could channel productivity increases into getting either more income or fewer working hours.[25] They argue that taking this income effect into account mitigates the differences in welfare across countries of a similar level of productivity.

Having established the long-run relationship, we can now move to our short-run identification, assuming that the income effects discussed above are not immediate.

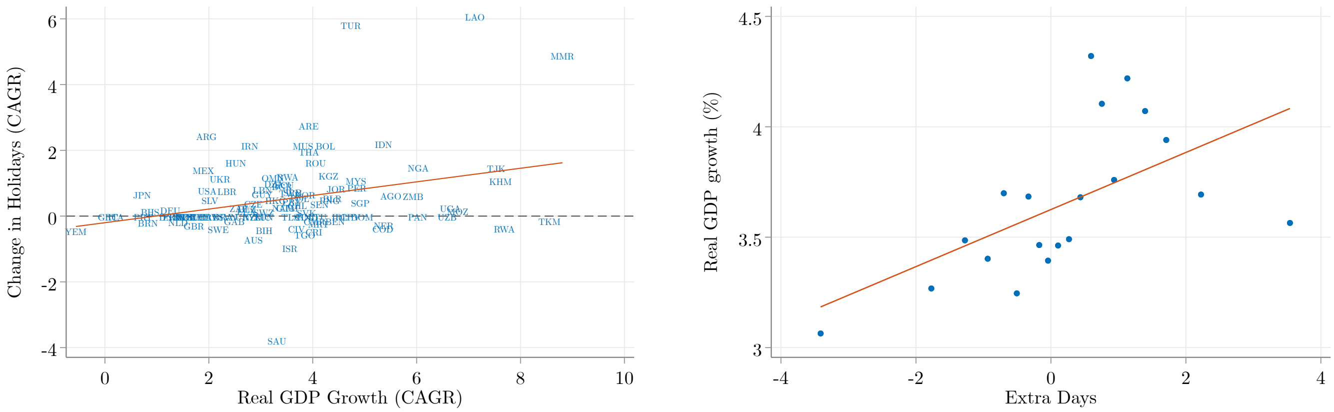
Our short-run variation in working days increases GDP growth

Here, we show preliminary graphical evidence that the short-run increase in working days has a positive impact on economic growth. To eyeball the relationship, we group our data into 20

[25] Furthermore, Aguiar and Hurst (2007) estimate a total gain in leisure from 1965 to 2003 of 5.9 to 10.5 additional weeks of vacation per year. Similarly, Kopytov et al. (2023) show how a decrease in recreational prices can account for a large share of the decline in work hours. Technological progress has made leisure cheaper, probably including vacation costs, travel costs, and so on, contributing to a long-run decrease in yearly working days as well.

Figure 4: Long and Short Run Relation Between GDP Growth and Public Holidays

(A) Long-Run Correlation (B) Short-Run Correlation



Notes: Panel (A) presents the long-run correlation between public holidays and growth. Both axes are reported as a compound annual growth rate (CAGR). Real GDP is computed as an annualized percentage change between the years 2000 and 2019 (in local currency). Change in holidays denotes the annualized percentage change between average holidays in the period 2000-2002 and 2017-2019. The plotted slope is 0.21, p-value = 0.02. We can also invert the bivariate plot and compute a regression with a long-run relationship between GDP and working days. The estimated elasticity is 11.8 (p-value < 0.01). This is very close to the estimates using overall work hours per year instead of holidays in (Boppart and Krusell, 2020, Appendix C.8) and Bick et al. (2018). Panel (B) shows the short-run correlation between "extra days" and GDP growth. Extra days are defined as deviations from the average number of working days in a calendar year (252 according to our sample). This figure corresponds to a binned scatter plot where extra days are grouped in equal-size bins on the horizontal axis. Also, we control for country and year fixed effects. Real GDP growth in local currency. Slope coefficient = 0.13 pp. and p-value < 0.01

equal-sized bins, controlling for country and year fixed effects. Panel (B) in Figure 4 displays the corresponding binned scatter plot, depicting the positive and statistically significant relationship.[26] It is worth remarking on two aspects of this exercise. First, the variation in our measure of working days comes only from those holidays falling on a weekend in a given year. In that sense, it is kind of a "reduced form" estimate. But at the same time, this is the quantity we care about since we are interested in how an additional public holiday for a year could lower GDP growth. The second remark is that the short-run identification behind this estimate works, as expected, in the opposite direction of the powerful income effect documented above. The short-run coefficient is positive. The following sections formally test this short-run effect

[26]Note that we often refer to *extra days* instead of working days. That is because, in our setup, working days in a year only change due to variations in the days of the week when public holidays take place.

and show its robustness.

4 Estimating the Output Cost of a Public Holiday

We now move to formally test the short-run relation between changes in working days and growth. We focus on growth mainly for three reasons: (i) the nature of the shocks we are studying are both transitory and small in magnitude, thus it is unlikely to find a large effect on other aggregate variables such as consumption or investment. (ii) Country-level panel data is typically less available for other variables we might be interested in. (iii) It is unclear how to interpret results on other aggregate variables, such as government revenues, due to several simultaneous effects.

To estimate the effect of additional holidays on GDP growth, we have a linear specification that maps our empirical strategy with the framework presented in Section 2. In particular, we estimate

$$\Delta y_{ct} = \beta \, \Delta \log(\text{working days}_{ct}) + \mu_c + \lambda_t + \varepsilon_{ct}, \tag{3}$$

where Δy_{ct} represents the (log) change in real GDP for country c in year t. On the right-hand side, $\Delta \log(\text{working days}_{ct})$ denotes the log change in working days, defined as in Equation (2), and the coefficient for β represents α_D in our framework. In addition, μ_c and λ_t represent country and year fixed effects, and ε_{ct} represents the error term, which, unless otherwise stated, will have standard errors clustered at the country level.

The equation above is similar to the one used by Campante and Yanagizawa-Drott (2015a), with the difference that us using changes in working days allows us to map the regression to the coefficient from the aggregate production function, whereas their model has a less direct connection with this framework. In particular, Campante and Yanagizawa-Drott (2015a), who study the effect of Ramadan fasting on output growth, use the (log) number of Ramadan fasting hours (in level) as the variable of interest. Their exogenous variation comes from differences in daily daylight hours during Ramadan, and their identification follows from this variation affecting the evolution of inputs (capital and labor) and/or productivity. We think of our source of variation as similar in "spirit", but with the advantage that it has a direct connection with our simple framework.

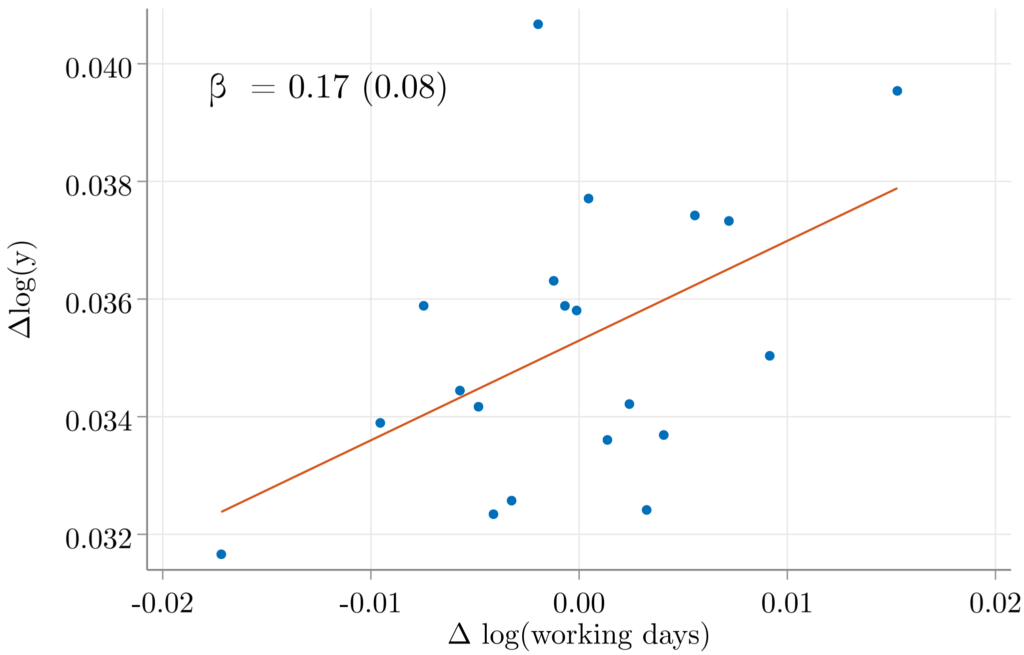
Figure 5 displays the main result of this paper, namely our estimate of the within-country effect of working days on output. For details on the regression estimates, see column (1), Table D.3 in Online Appendix D. We find an elasticity of working days to output of 0.17 (SE $=$ 0.08). In addition, column (2), Table D.3 in Online Appendix D estimates a *constrained* regression assuming constant returns to scale (that is, $\alpha_L + \alpha_K = 1$) and finds a labor share of 0.54 (SE $=$ 0.08), in line with a time series average of the global labor share in Karabarbounis and Neiman (2014) over the same period.[27]

The finding that additional working days—resulting from holidays falling on weekends—have a significant effect on GDP growth highlights the economic cost associated with holidays. Having more public holidays in a given year negatively impacts a country's output. However, the fact that the estimated elasticity is well below one suggests that a substantial portion of the output loss is eventually recovered, either through firms adjusting their production schedules or through demand shifts related to holiday activities (e.g., tourism). This is at the core of our contribution: providing a way to measure the elasticity of output to working days. One

[27]Figure 1 in their paper estimates roughly the same overall labor share over the period 2000-2014.

example where our estimates are relevant for decision-making is when countries debate over the cost of introducing new holidays. For instance, it is common for policymakers to propose including a one-time "bridge holiday" when some public holiday takes place on a Tuesday or Thursday. Our estimates provide a benchmark for assessing the effective output cost of such policies.

Figure 5: The Output Cost of an Additional Working Day



Notes: This figure shows estimates from Equation (3) for our baseline sample. Working days are constructed following Equation (2) and a country-specific definition of weekend days. For the dependent variable, we use real GDP in local currency. Text at the top left of the figure reports the estimated coefficient and standard error. Robust standard errors clustered at the country level.

We also estimate our model using log working days in levels to compare our results with Campante and Yanagizawa-Drott (2015b). Column (2), Table D.4 in Online Appendix D shows an estimated coefficient of 0.27 (SE = 0.09). This is slightly below the effect estimated in Campante and Yanagizawa-Drott (2015b), who find an elasticity of GDP growth to the *average* number of Ramadan fasting hours of -0.09 (SE = 0.05). To illustrate this, consider the results using variables in level (i.e., not in logs or in first differences) and the following back-of-the-envelope calculation. If we assume a 5-day workweek schedule and no other public holidays, we have 20 business days during the month of Ramadan. Suppose also an average of 7 hours worked per business day (roughly our sample average). Then, a one-hour increase in the average number of Ramadan hours translates into roughly 3 business days of fasting. Their estimate for an increase in one hour of average Ramadan hours is -0.01 (SE $=$ 0.003), approximately 3 times the effect we find on one additional working day ($\beta = 0.0011$, SE $=$ 0.000), but within our 95 percent confidence interval (see column 1, Table D.4 in Online Appendix D).

The effects we report above are economically meaningful when compared to usual changes in growth forecasts. For instance, the average country in our sample has a range of 4.7 days in working days induced by our calendar variation (see Table 2). Multiplying by the estimated coefficient would mean around half a percentage point of lower GDP growth in the year of top vs bottom holidays falling on a weekend. As a benchmark, the mean absolute value of a forecast revision by the IMF's World Economic Outlook was 0.75pp (April 2019 vs Oct 2018). As noted in Figure 3, this could be larger for many countries that have wider than average ranges.

Our results also matter for year-to-year variations. For example, Spain, Mexico, and South Korea had two additional working days in 2023 vis-à-vis the previous year. Our results would predict, all else equal, an effect of 0.2pp. higher growth. The opposite would be true for France, which had 2 fewer working days that year. Similarly, Chile experienced a decrease of 3 working days in 2023, which would *transitorily* decrease growth by 0.3pp. As a benchmark, that is half of the usual forecast revision made by its central bank in the decade 2010-2019.

5 Robustness and Placebos

We now check the robustness of our results to different specifications, samples, potential threats to the identification, and caveats on the algorithm for collecting working days data. In particular, we show below that there is no significant relation between our measure of working days, employment, and daily hours. In addition, we show that our results are robust to variations on the sample selection, as well as to the inclusion/exclusion of other shocks (e.g., terms of trade shocks), to controlling for policy changes in the number of holidays or labor regulations (e.g., paid annual leave), among others.

5.1 Testing the Identification Assumption

One key identification assumption we made in Section 2 was that our variation in yearly working days did not propagate throughout the labor market besides its direct effect. That is, changes in *effective* public holidays did not affect employment, average daily hours worked, and our occupational parameter ϕ_t. While we cannot test for the latter, we do have some data that allows us to test the relation between changes in working days and the two former (employment and hours). For that, we use employment data from PWT and average hours worked weekly from Bick et al. (2019) (divided by number of business days per week from our data).[28] In particular, we estimate

$$\Delta \log(\text{working days}_{ct}) = \beta \Delta \log x_{ct} + \mu_c + \lambda_t + \varepsilon_{ct}, \tag{4}$$

[28] Data on weekly hours is, however, much limited, with only some European countries and the United States in the sample.

where x_{ct} denotes either employment or average daily hours. Table D.5 in Online Appendix D presents the results. Consistent with our identification strategy, we find coefficients not statistically significant and small in magnitude.

5.2 Alternative Specifications and Sample Selection

Below, we describe a battery of different robustness checks we performed. All these results are reported in detail in Table 4.

Terms of Trade shocks. As in Campante and Yanagizawa-Drott (2015a), we consider robustness to the possibility of terms of trade shocks by controlling for the price level of imports and exports (PWT). Column (1) in Table 4 presents practically the same results as our baseline specification, with a coefficient of 0.16 (SE = 0.08).

Excluding Financial Crisis. Column (2) estimates the baseline elasticity but drops observations from the years 2008-2009. The intention is to rule out that the elasticity is driven by the large financial and economic crisis of the years 2008-2009. Results again remain unchanged, which is reasonable as much of the variation due to the Great Recession is common across countries and thus captured by the year fixed-effect.

Including year-region FE. The map in Figure 3 may give the impression of some regional clustering of countries that have a large variation in effective holidays across years. One potential concern would be that our results do not come from the calendar variation, but that the coefficient of interest is picking up some of the variation of these regions over time. To correct for this possibility, we check whether our results hold after controlling for differential regional effects in a given year (e.g., a crisis in Europe in 2012). Column (3) incorporates year-region fixed effects and finds that overall, results remain unchanged (Coef. 0.16, SE = 0.08).

Countries with a large range of variation in effective holidays. Our baseline regression has the potential concern that, when computing the within-country effect of extra days, several countries present little variation (e.g., due to moving holidays to the next working day), and that this may dilute the average effect. If this were a major threat to the robustness of our results, a regression only considering a sub-sample of "high-range countries" (in terms of extra days) should present a substantially larger elasticity. In other words, excluding countries such as the United States or New Zealand (see Figure 2) should increase the effect of holidays on growth. To test this hypothesis, column (4) estimates our baseline regression, but now we restrict the sample to countries with a range of extra days greater than or equal to the sample median (range = 4 days). Results show only practically no change with respect to our baseline sample.

Excluding tax havens. Column (5) tests if the results are driven by countries considered tax havens. This is important as these countries may have GDP that faces large movements for tax avoidance reasons of investors and multinationals, rather than real activity (see Lane, 2017). This concern would mean our baseline estimates would have a bias towards zero. To test for this concern, we use the definition of tax haven in Coppola et al. (2021) and later exclude these countries from the regression.[29] Results overall remain unchanged after excluding these countries from our sample.

Quarterly regressions. In narrower time periods, the proportional loss in production from a one-day holiday may be substantially larger than in a year. But in standard macroeconomic practice, the quarterly data is typically corrected for holidays, unlike the yearly data we use. In

[29]See Table D.2 in the Online Appendix D for the list of countries excluded.

fact, the IMF Quarterly National Accounts Manual (chapter 7) mandates that these "calendar effects should be removed from the series".[30] To make that test, we recalculated our indicator of effective holidays and extra working days in each specific quarter for each country. Then, we matched our data with the IMF's quarterly data on GDP growth vis-à-vis the same quarter of the previous year. This keeps consistency in the dates and seasonality. Estimating our baseline specification with this year-over-year and quarter-over-quarter changes displays estimates substantially smaller (e.g., an order of magnitude smaller for quarter-over-quarter estimates). Table D.6 in Online Appendix D) presents the results, with estimated coefficients of 0.04 (SE = 0.02) and 0.01 (SE = 0.00).[31]

Table 4: Robustness Exercises

	Dependent Variable: GDP Growth				
	(1) Controlling for terms of trade	(2) Excl. Financial Crisis	(3) Year-region FE	(4) High extra days range	(5) No tax havens
Δ log(working days)	0.16**	0.16**	0.16*	0.17**	0.17**
	(0.08)	(0.08)	(0.08)	(0.09)	(0.08)
Country Fixed Effect	Yes	Yes	Yes	Yes	Yes
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes
Time-Region Fixed Effect	No	No	Yes	No	No
Observations	2,379	2,379	2,442	1,692	2,161
Countries	157	157	165	109	147
Adj. R^2	0.38	0.38	0.40	0.36	0.37

Notes: This table shows different robustness exercises for our baseline results. Namely, different estimations of Equation (3). Column (1) controls for the price level of exports and imports. Column (2) excludes the years 2008-2009. Column (3) includes year-region fixed effects. Columns (4) use a sub-sample that only considers countries with a range of extra days greater than or equal to the sample median. Column (5) estimates the baseline regression but excludes countries defined as "tax havens" by Coppola et al. (2021). Standard errors are reported in parentheses and clustered at the country level. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

[30]Chapter 7 of the IMF's Quarterly National Accounts Manual (2017) explicitly states that "calendar effects should be removed from the series because they could affect negatively the quality of decomposition into unobserved components". Importantly for our estimations, there is no equivalent correction when dealing with yearly data (e.g., the IMF's System of National Accounts 2008).

[31]Note that while the effect of an additional working day should generate a large increase in growth at the quarterly level, the quarterly elasticity should present similar values when comparing with the baseline results. However, we find an estimated elasticity roughly 10 times smaller when looking at the quarterly data.

5.3 Policy Changes in the Number of Holidays

In previous sections, we emphasized how our data provide exogenous variation to the number of working days. However, one could potentially worry that our results could be confounded by policymakers' actions. They may use permanent holidays as a tool that may affect output or increase popularity. In that sense, it might be possible that some of our results could potentially come from a few permanent changes to public holidays rather than the transitory shocks to working days. Note that this potential concern would only be a partial threat to our identification strategy, as these new holidays would affect output in the year they are introduced. But after the first year, these holidays are still subject to our calendar variation.[32]

To account for this potential source of endogeneity, we compute two dummies to identify years of policy changes in holidays. One matches holidays by name and date. That is a dummy that takes the value 1 if there is at least one holiday in a year $t > t_0$ that does not match the name or date of any holiday in the benchmark year t_0. The other matches the number of public holidays across years, creating a dummy that takes the value 1 if the number of public holidays in a given year does not match the number of holidays in the benchmark period. For both variables, we define a country-specific base period using the first-year holidays available in the data.[33] To see the procedure to construct both variables please refer to Online Appendix C.

Table 5 controls for these "permanent changes" to the number of public holidays. Overall, we see little change in the elasticities of interest. Columns (1)-(3) display point estimates in the

[32]For example, imagine a new holiday approved for a Friday of a given year. This policy change would affect working days in that year, but would not affect output in the next 2 years, where the holiday would end up on a weekend.

[33]We also try setting the base period as the year 2000, getting similar results (see Table D.7 in Online Appendix D.)

range of 0.16 to 0.15, barely below the baseline point estimate, though not statistically different. Table D.7 in Online Appendix D shows that results also hold if we set the base period to the year 2000 for all countries.

Table 5: Controlling for Alternative Definitions of Permanent Holiday Changes

	Dependent Variable: GDP Growth		
	(1)	(2)	(3)
	No name/date match dummy	Diff. *N* of holidays	Both
Δ log(working days)	0.16**	0.16**	0.15*
	(0.08)	(0.08)	(0.08)
Country Fixed Effect	Yes	Yes	Yes
Year Fixed Effect	Yes	Yes	Yes
Observations	2,461	2,461	2,461
Countries	166	166	166
Adj. R^2	0.37	0.37	0.37

Notes: This table compares our baseline results with different specifications that control for permanent changes to the number of legal holidays. Column (1) controls for a dummy that takes the value 1 if in a given year there is at least one holiday that does not match the date or name of any holiday in the baseline year (the first year that country information is available). Column (2) controls for a dummy that takes the value 1 if the number of public holidays, excluding holidays "in lieu" (i.e., added to replace a holiday on a weekend) differs from the number of holidays in the baseline year (also corrected by holidays "in lieu"). Column (3) adds both dummies to the baseline regression. All specifications include country and year fixed effects. Standard errors in parentheses and clustered at the country level. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

5.4 Other Potential Confounders: Paid Annual Leave and Informality

Someone may think that changes in working days might potentially be correlated with changes in other policy variables like paid annual leave or informality. For example, it might be that part of our results could come from a government substituting public holidays with paid annual leave. Similarly, it might be possible that years with more working days affect informality, especially in countries with strict labor regulations in terms of overtime or firing costs. In order to test for these potential concerns, we use data on paid annual leave and informality from the World Bank and the International Labor Organization (ILO), respectively. The former has a country panel of annual paid leave regulations for different tenures over the period 2004-2019, covering almost all of our period of interest. The latter source, ILO, has information on the informality share, though for a far more limited country panel starting in 2011, with 119 countries, but where roughly 30 percent have only 1 observation. Still, both sources of data allow us, to some extent, to see if their dynamics could be affecting our estimates for the effect of working days on growth.

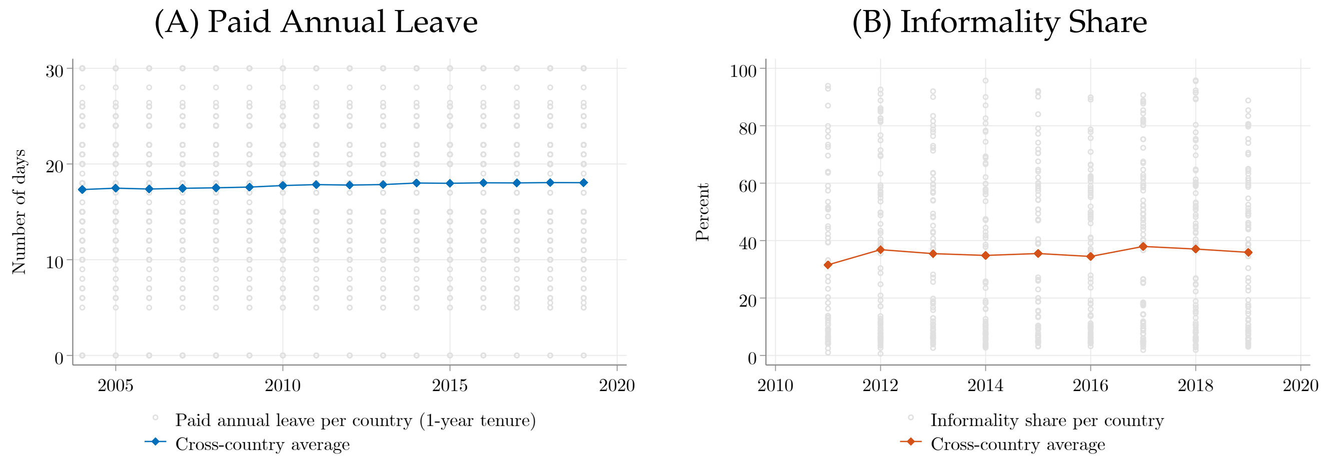
Figure 6 shows the average time series for the cross-country average of paid annual leave and informality, as well as the heterogeneity across countries. In addition, Table 6 displays the share of countries that changed the number of paid annual leave for different tenures. Given the fact that we are interested in year-to-year variation in holidays, it is reassuring that less than 1 percent of the countries with data on paid annual leave changed their regulation over 2-year windows. Therefore, it is unlikely to impact our estimations that exploit year-on-year variation. Furthermore, even for long-run changes, there is little variation. Only one in six countries (15-18 percent) of our sample changed at some point the paid annual leave during the 15-year window (2004 - 2019). So most of our observations do not face changes in annual leave.

Table 6: Share of Countries Modifying Paid Annual Leave Regulations by Horizon

Paid annual leave	% changing after 2Y	% changing after 5Y	% changing after 10Y	% changing after 15Y
1-year tenure	0.89	4.35	11.35	15.92
5-year tenure	0.89	4.35	12.06	17.83
10-year tenure	0.89	4.35	10.64	17.20

Notes: This table shows the share (percent) of countries that changed the legal number of days of paid annual leave. Data for annual leave from the World Bank. All changes are with respect to the initial year that the data is available (year 2004).

Figure 6: Evolution of Paid Leave and Informality



Notes: This figure plots each country's evolution of annual paid leave and share of informal sector workers, along with the time series for the cross-country average. Gray circles denote individual observations. The red line computes the cross-country average. Paid annual leave is presented for workers with 1 year of tenure.

Now, to test whether our findings are driven by changes in either of these variables, we perform two exercises. First, Table D.8 in Online Appendix D estimates our baseline regression, but controls for changes in paid annual leave. Importantly, across all three specifications, the point estimate for the elasticity is the same as in the baseline regression. On the other hand, given the more restricted data on informality, we break the baseline regression into above/below median informality share. Table D.9 in Online Appendix D shows an interesting result: the cost of an additional public holiday is larger for countries below the cross-sectional median informality share, with an estimated coefficient of 0.22 (SE = 0.09). That is, countries with a larger formal sector exhibit a larger benefit (in terms of output) in response to an additional working day. Conversely, countries above the median informality share do not exhibit a statistically significant increase in growth in response to our year-on-year variation in working days.

6 Heterogeneity Across Sectors

In this section, we explore how our exogenous variation affects differently across sectors. To do so, we use sector-level output to study whether specific sectors are more exposed to shocks to yearly working days. In principle, one would expect that given most countries' regulations on public holidays, some sectors like services (e.g., banking services) would be more affected than, say, agriculture. There are various reasons why public holidays could generate heterogeneous effects across sectors. For example, in agriculture, the natural processes could grow even if workers do not show up for a day, provided they are not missing a critical task, like harvesting on time. On those crucial dates, the potential output effects of legal holidays could be bypassed by timely planning or through higher wages. In contrast, more urban operations like manufacturing and services could face a stronger effect on output. This is due to labor regulations in most countries that limit firms' production during public holidays. For example, Georges-Kot et al. (2024) show that in France, around 80 percent of employees do not work when a public holiday falls on a weekday, consistent with collective agreements in most industries in France that entitle employees to additional paid leave as long as the holiday falls on a weekday.

To test for this hypothesis, we re-estimate Equation (3), but using sector-level outputs on the left-hand side (UNCTAD). We estimate our baseline regression for three sectors: agriculture (ISIC codes A-B), industry (ISIC codes C-F), and services (ISIC codes G-P). Table 7 presents the results. Column (1) shows no effect of changes in working days on agricultural output, while columns (2) and (3) show large responses from output in the industry and services sectors. In particular, industry, which includes manufactures, presents an estimated coefficient of 0.46 (SE = 0.17), close to three times larger than our baseline result for aggregate output. Similarly, the estimated coefficient on services is also somewhat larger than our baseline result, with an estimated elasticity of 0.21 (SE = 0.10). Even though the service sector includes sectors that may benefit from an additional public holiday (e.g., restaurants and hotels), the estimated coefficient suggests that other sectors affected by the holiday are driving this result (e.g., financial services).

Table 7: Effect of Public Holidays Across Sectors

	Dep. Variable: log change in sectoral output		
	(1) Agriculture	(2) Industry	(3) Services
Δ log(working days)	-0.06	0.46***	0.21**
	(0.23)	(0.17)	(0.10)
Country Fixed Effect	Yes	Yes	Yes
Year Fixed Effect	Yes	Yes	Yes
Observations	2,660	2,679	2,679
Countries	178	179	179
Adj. R^2	0.02	0.07	0.25

Notes: This table presents results of Equation (3), but using as dependent variable sector-level output from UNCTAD. All left-hand side variables are expressed as the log-change in production (2015 US dollars). Column (1) presents results for agriculture, hunting, forestry, and fishing (ISIC A-B). Column (2) presents results for industry, which includes mining, manufacturing, utilities, and construction (ISIC C-F). Column (3) presents results for services, which include wholesale, retail trade, restaurants and hotels, transport, storage, and communications. Transport, storage, and communication, and other activities (ISIC G-P). The constant term is not reported. All specifications include country and year fixed effects. Standard errors are reported in parentheses and clustered at the country level. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

7 Extensions: Public Holidays Impact Subjective Well-Being and Health

We now turn to natural extensions of our setting. Our exogenous variation in yearly working days may affect several other variables important for policy making. We will focus on two commonly debated topics: subjective well-being and health (deaths). The first topic (subjective well-being) relates to trade-offs authorities face when designing labor regulations, as they need to choose between paid days off and public holidays. In that sense, getting a better understanding of how agents value additional holidays is a useful input for policymakers. The second topic (health) intends to get a better sense of how public holidays affect deaths by type. For instance, it is common to hear about car accidents as people travel for holidays. In addition, several jobs present risks, and thus, additional days may increase work-related deaths. Moreover, extra holidays may affect waiting lists for medical procedures (e.g., surgery).[34]

7.1 Subjective Well-Being

Here, we study whether calendar variations affect the perceptions of subjective well-being (SWB) of individuals. Here we closely follow Campante and Yanagizawa-Drott (2015a)'s method to get a sense of the effects on well-being using the World Values Survey (WVS). Like them, we compute the same two dummy variables:

1. **Happiness**: dummy variable that takes the value one if the respondent declares to be "quite happy" or "very happy" and zero otherwise.[35]

2. **Life Satisfaction**: dummy variable that takes the value one if the respondent declares a satisfaction greater than 5 (on a scale from 1-10), and zero otherwise.[36]

Importantly, the phrasing of the questions suggests that happiness is more of a transitory

[34]A recent example of this happened after the death of Queen Elizabeth II, where public holidays in countries of the Commonwealth generated a large rescheduling of surgeries (roughly 55 percent in New Zealand).

[35]"Taking all things together, would you say you are: ... ".

[36]"How satisfied are you with your life as a whole these days?".

feeling, while life satisfaction is the perception of more permanent well-being. Since our shock is a transitory one, and people arguably know it, one would also expect a transitory jump in happiness.

Campante and Yanagizawa-Drott (2015a) estimate the effect that longer Ramadan fasting has on individual measures of SWB among Muslims. To do so, they combine microdata from the WVS with their average measure of log fasting hours (at the capital city of the country). In a similar fashion, we estimate

$$y_{ict} = \beta \, \text{working days}_{ct} + X_{ict}\gamma' + \mu_c + \lambda_t + \varepsilon_{ict}, \tag{5}$$

where y_{ict} denotes the subjective well-being dummy (happiness or life satisfaction) for individual i, country c, and year t. Notice we use our measure of working days (in level) as our main variable of interest. We do so to study the effect of an additional working day (rather than its log-change) on these subjective measures of well-being. Unlike our main results, where we estimated an elasticity derived from an aggregate production function, now we remain agnostic about the theory in the background and simply estimate a reduced-form effect. Moreover, given that the data on subjective well-being is not a panel, but a pseudo-panel, we cannot control include individual fixed effects to control for time-invariant characteristics of the respondents. We do, however, include a vector of individual-level control variables X_{ict} to reduce residual variation, as well as country and year fixed effects. This set of controls is the same baseline and additional control variables in Campante and Yanagizawa-Drott (2015a) to keep the exercise comparable. In particular, we estimate the baseline model controlling for a second-order polynomial in age, number of children, and dummies for education, gender, and marital status.

Then, for additional robustness, we also incorporate income deciles, city size, and a dummy for social class as in the WVS.

Table 8 shows the results. Columns (1) and (2) find a negative coefficient of additional working days on happiness, while columns (3) and (4) show no statistically significant effect on life satisfaction. The results suggest that the marginal holiday increases short-run subjective well-being, as expected due to the transitory nature of the shock. We see this lack of a permanent change in satisfaction as a useful placebo test since there is no obvious channel why an extra transitory holiday could have permanent effects. Overall, our results are coherent with the differential phrasing of the questions, where happiness is more of a short-term feeling, while life satisfaction has to do with a more permanent perception.

Beyond statistical significance, it is useful to get a sense of the magnitudes of the effects on short-run happiness. Column (1) displays that one additional working day reduces the probability of being "happy" by 0.6 percentage points, which is significant at the 95 percent level. As a benchmark, the above effect on happiness is roughly 5 percent of the average difference in happiness between married and divorced respondents (see Table D.10 in Online Appendix D).

7.2 National Holidays and Health Outcomes

It is common to hear in the media about increases in transport accidents during holidays. Also, people often link self-harm deaths with job-related stress. This subsection addresses these common views by exploiting our identification strategy and using health outcomes from the Global Burden of Disease (GBD). We study different causes of death, including transportation deaths, self-harm deaths, and interpersonal violence, among others.

Table 8: The Effect of Public Holidays on Subjective Well-Being

	Happiness		Life Satisfaction	
	(1)	(2)	(3)	(4)
Working days	-0.006**	-0.016***	-0.010	-0.014
	(0.003)	(0.005)	(0.009)	(0.024)
Observations	153,888	94,895	154,231	95,078
Countries	70	57	70	57
Adj. R^2	0.10	0.12	0.10	0.15
Country Fixed Effect	Yes	Yes	Yes	Yes
Year Fixed Effect	Yes	Yes	Yes	Yes
Baseline controls	Yes	Yes	Yes	Yes
Additional controls	No	Yes	No	Yes
Dep. Variable Avg.	0.85	0.85	0.73	0.73

Notes: Dependent variables are a dummy for happiness, which equals 1 when the respondent feels "happy" or "quite happy" and 0 otherwise, and a dummy variable for life satisfaction, which equals 1 when the respondent reports a life satisfaction greater than 5 on a 1 to 10 scale. The variable of interest is our measure of extra days. Baseline controls include *age*, age^2, number of children, and dummies for education, gender, and marital status. Additional controls consist of income decile, city size (8 categories), and dummies for social class (upper class, upper middle class, lower middle class, working class, lower class). Standard errors are in parentheses and clustered at the country level. All specifications include country and year fixed effects. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

As there is usually a lag between a negative health shock (e.g., the diagnosis of a disease) and eventual death, most measures of deaths should not respond to calendar variations or the number of holidays. However, self-harm deaths, accidents, or murders may be sensitive to our approach. Therefore, we focus mainly on death causes that we believe may be sensitive to the number of yearly working days.

In particular, we estimate

$$D_{ct} = \beta \text{working days}_{ct} + \mu_c + \lambda_t + \varepsilon_{ct}, \quad (6)$$

where D_{ct} denotes deaths per million people. Table 9 presents results for different death causes.[37]

[37] To correct for different population sizes, we compute deaths as deaths per million people.

From column (1), note that, as expected, there is no significant effect of holidays on total deaths per million people. Columns (2) and (3) show that holidays have an insignificant effect on interpersonal violence and self-harm deaths. Transport injury deaths present a coefficient only significant at the 90 percent level. On the contrary, results in column (5) suggest that unintentional injury deaths (e.g., falls) significantly increase with the number of working days. Namely, one extra working day generates an increase of 3.47 (SE = 1.11) deaths per million people, significant at the 99 percent level. Regarding the mechanism, unintentional injuries are probably driven by higher on-the-job accidents. Finally, to compare the results, column (6) adds a specification using WDI data on intentional homicides, but we do not find a significant effect on that variable.

Table 9: The Effect of Public Holidays on Health Outcomes

	Dependent Variable: Deaths per Million People					
	All	Interp. Violence	Self Harm	Transport Inj.	Unintentional Inj.	Intentional Homicides
	(1)	(2)	(3)	(4)	(5)	(6)
Working days	-14.73	-0.34	0.32	1.50*	3.47***	-0.67
	(18.64)	(0.44)	(0.27)	(0.87)	(1.11)	(0.56)
Country Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2616	2616	2616	2616	2616	1934
Countries	164	164	164	164	164	146
Adj. R^2	0.91	0.90	0.96	0.95	0.67	0.92
Dep. Variable Avg.	8022.89	79.27	108.71	186.34	230.93	77.49

Notes: This table shows estimates from Equation (6) using different measures of the number of deaths (per million people) as the dependent variable. Data for the number of deaths from the Global Burden of Disease (GBD) and the WDI (column (6)). Extra Days in level and computed using Equation (2). All specifications include country and year fixed effects. Standard errors are reported in parentheses and clustered at the country level. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

To get a better sense of the magnitude of the coefficients, we will use our sample average and France as examples. For our baseline sample, the average number of deaths per million people due to unintentional injuries is roughly 248, while in France, the average is approximately 406 per million over the same period. From Table 9, we find that one additional working day increases unintentional injury deaths by 3.47 per million people. Given the sample average range in working days of 5.2 and 4 in France, calendar variations may reduce up to 18 deaths per million ($3.47 \times 5.2 = 18$) considering our baseline sample, and 13.9 deaths per million in France ($3.47 \times 4 = 13.9$), which are 7.3 and 3.4 percent of the yearly deaths per million people (by that cause), respectively.

8 Concluding Remarks

The number of legal working days is a collective decision made by countries. In that context, our paper measures the aggregate effects of the marginal working day. We do so by introducing a new global panel of country-level public holidays and a novel year-to-year identification. The latter approach helps isolate the arguably exogenous variations in effective working days from the long-run changes, like income effects correlated with more holidays. To identify this effect, we used the change in effective working days induced by calendar variation when a scheduled public holiday falls on a weekend. This type of variation is less relevant in the US but meaningful in Europe, Latin America, and parts of Asia, among others.

We estimate a working-day elasticity of GDP of around 0.17. This result is robust to controlling for policy changes in holiday regulation, confounding trends in paid annual leave, and broadly to a large set of robustness exercises about sample, measurement, and identification. As expected, the elasticity is also stronger in activities that are more likely to be interrupted by these holidays, like industry and services. In contrast, we find no statistically significant effect on broad activities that are likely to continue (e.g., agriculture). Our identification also allowed us to study other relevant variables for policy making, like subjective welfare and deaths. In that context, we find that public holidays are also related to fewer work-related accidents and more short-term happiness.

Both our dataset on holidays and our variation of working days are of independent interest to researchers, who could use them to test for other effects of legal working days or holidays. We believe our results are important for measurement as well, as aggregate time series typically do not correct for variations in working days at the yearly level. As mentioned, the corrections induced by our calendar variation in legal working days could be over half the GDP forecast corrections made at the IMF. Yet another potential application stems from our paper having a plausible causal inference, which tends to be very infrequent in macroeconomics. As such, our novel data and approach could be of use to other authors as a source of an "identified moment", to discipline quantitative models aimed at other questions (see Nakamura and Steinsson, 2018). We see these applications as a fruitful avenue for future research.

References

AGUIAR, M., AND E. HURST (2007): "Measuring Trends in Leisure: The Allocation of Time Over Five Decades," *Quarterly Journal of Economics*, 122, 969–1006, https://doi.org/10.1162/qjec.122.3.969.

AKSOY, C. G., J. M. BARRERO, N. BLOOM, S. J. DAVIS, M. DOLLS, AND P. ZARATE (2023): "Time Savings When Working from Home," Working Paper 30866, National Bureau of Economic Research, 10.3386/w30866.

AL-UBAYDLI, O., AND J. A. LIST (2022): "The 4-Day Workweek Is (Almost) Here," *WIRED - Ideas - December 2022*.

ALTONJI, J. G., J. OLDHAM ET AL. (2003): "Vacation laws and annual work hours," *Economic Perspectives-Federal Reserve Bank of Chicago*, 27, 19–29.

ANAND, P., J. KRISHNAKUMAR, AND N. B. TRAN (2011): "Measuring welfare: Latent variable models for happiness and capabilities in the presence of unobservable heterogeneity," *Journal of Public Economics*, 95, 205–215.

ATKINSON, M. D., AND A. FOWLER (2014): "Social capital and voter turnout: Evidence from saint's day fiestas in Mexico," *British Journal of political science*, 41–59.

BICK, A., B. BRÜGGEMANN, AND N. FUCHS-SCHÜNDELN (2019): "Hours worked in Europe and the US: New data, new answers," *Scandinavian Journal of Economics*.

BICK, A., N. FUCHS-SCHÜNDELN, AND D. LAGAKOS (2018): "How do hours worked vary with income? Cross-country evidence and implications," *American Economic Review*, 108, 170–99.

BLOOM, N., R. HAN, AND J. LIANG (2022): "How hybrid working from home works out,"Technical report, National Bureau of Economic Research.

BOPPART, T., AND P. KRUSELL (2020): "Labor supply in the past, present, and future: a balanced-growth perspective," *Journal of Political Economy*, 128, 118–157.

BOTERO, J., S. DJANKOV, R. PORTA, F. C. LOPEZ-DE-SILANES, AND A. SHLEIFER (2004): "The Regulation of Labor," *The Quarterly Journal of Economics*, 119, 1339–1382.

BRUNO, G., C. LUPI, C. PAPPALARDO, AND G. PIRAS (2006): "The cross-country effects of EU holidays on domestic GDP," *ISAE - Italian Institute of Studies and Economic Analysis working paper*, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=921577.

CAMPANTE, F., AND D. YANAGIZAWA-DROTT (2015a): "Does religion affect economic growth and happiness? Evidence from Ramadan," *The Quarterly Journal of Economics*, 130, 615–658.

——— (2015b): "Does Religion Affect Economic Growth and Happiness? Evidence from Ramadan," *Quarterly Journal of Economics*, 130, 615–658.

CAMPBELL, T. T. (2023): "The four-day work week: a chronological, systematic review of the academic literature," *Management Review Quarterly*, 1–17.

CHANDRAN, A., A. A. HYDER, AND C. PEEK-ASA (2010): "The global burden of unintentional injuries and an agenda for progress," *Epidemiologic reviews*, 32, 110–120.

CONCHA-BARRIENTOS, M., D. I. NELSON, M. FINGERHUT, T. DRISCOLL, AND J. LEIGH (2005): "The global burden due to occupational injury," *American journal of industrial medicine*, 48, 470–481.

COPPOLA, A., M. MAGGIORI, B. NEIMAN, AND J. SCHREGER (2021): "Redrawing the map of global capital flows: The role of cross-border financing and tax havens," *The Quarterly Journal of Economics*, 136, 1499–1556.

CUELLO, H. (2023): "Assessing the Validity of Four-day Week Pilots,"Technical report, European Commission - Joint Research Centre.

FELDSTEIN, M. S. (1967): "Specification of the labour input in the aggregate production function," *The Review of Economic Studies*, 34, 375–386.

FRITZ, C., S. SONNENTAG, P. E. SPECTOR, AND J. A. MCINROE (2010): "The weekend matters: Relationships between stress recovery and affective experiences," *Journal of Organizational Behavior*, 31, 1137–1162.

GEORGES-KOT, S., D. GOUX, AND E. MAURIN (2024): "The value of leisure synchronization," *American Economic Journal: Applied Economics*, 16, 351–376.

HAMERMESH, D. S., AND J. BIDDLE (2022): "Days of Work over a Half Century: The Rise of the Four-Day Week,"Technical report, National Bureau of Economic Research.

JONES, C. I., AND P. J. KLENOW (2016): "Beyond GDP? Welfare across countries and time," *American Economic Review*, 106, 2426–57.

KARABARBOUNIS, L., AND B. NEIMAN (2014): "The global decline of the labor share," *The Quarterly journal of economics*, 129, 61–103.

KEYNES, J. M. (1931): "Economic possibilities for our grandchildren," in *Essays in persuasion*: Edition 2010 by Springer, 321–332.

KOPYTOV, A., N. ROUSSANOV, AND M. TASCHEREAU-DUMOUCHEL (2023): “Cheap thrills: the price of leisure and the global decline in work hours,” *Journal of Political Economy Macroeconomics*, 1, 000–000.

KUNZ-EBRECHT, S. R., C. KIRSCHBAUM, M. MARMOT, AND A. STEPTOE (2004): “Differences in cortisol awakening response on work days and weekends in women and men from the Whitehall II cohort,” *Psychoneuroendocrinology*, 29, 516–528.

LANE, P. (2017): “Notes on the treatment of global firms in national accounts,” *Economic Letter*.

LIST, J. A. (2023): “The Voltage Effect,” *Business Economics*, 1–6.

MONTERO, E., AND D. YANG (2022): “Religious festivals and economic development: Evidence from the timing of Mexican saint day festivals,” *American Economic Review*, 112, 3176–3214.

NAKAMURA, E., AND J. STEINSSON (2018): “Identification in macroeconomics,” *Journal of Economic Perspectives*, 32, 59–86.

RAGSDALE, J. M., T. A. BEEHR, S. GREBNER, AND K. HAN (2011): “An integrated model of weekday stress and weekend recovery of students.,” *International Journal of Stress Management*, 18, 153.

RAMASAMY, B., M. C. YEUNG, AND A. K. AU (2008): “Can holidays boost consumption? The case of Hong Kong,” *Journal of Public Affairs*, 8, 281–287.

REHM, J., R. ROOM, M. MONTEIRO, G. GMEL, K. GRAHAM, N. REHN, C. T. SEMPOS, AND D. JERNIGAN (2003): “Alcohol as a risk factor for global burden of disease,” *European addiction research*, 9, 157–164.

SCHLOTZ, W., J. HELLHAMMER, P. SCHULZ, AND A. A. STONE (2004): “Perceived work overload and chronic worrying predict weekend–weekday differences in the cortisol awakening response,” *Psychosomatic medicine*, 66, 207–214.

THORN, L., F. HUCKLEBRIDGE, P. EVANS, AND A. CLOW (2006): “Suspected non-adherence and weekend versus week day differences in the awakening cortisol response,” *Psychoneuroendocrinology*, 31, 1009–1018.

VECINO-ORTIZ, A. I., A. JAFRI, AND A. A. HYDER (2018): “Effective interventions for unintentional injuries: a systematic review and mortality impact assessment among the poorest billion,” *The Lancet Global Health*, 6, e523–e534.

WEIGELT, O., C. J. SYREK, A. SCHMITT, AND T. URBACH (2019): “Finding peace of mind when there still is so much left undoneA diary study on how job stress, competence need satisfaction, and proactive work behavior contribute to work-related rumination during the weekend.,” *Journal of Occupational Health Psychology*, 24, 373.

The Output Cost of Public Holidays

Online Appendix—Not for Publication

Lucas Rosso Rodrigo Wagner

A Data Appendix

Holiday data collection. This section walks through the process of collecting cross-country national holiday data for the period 2000-2019. The scraping process of holidays consists of three steps.

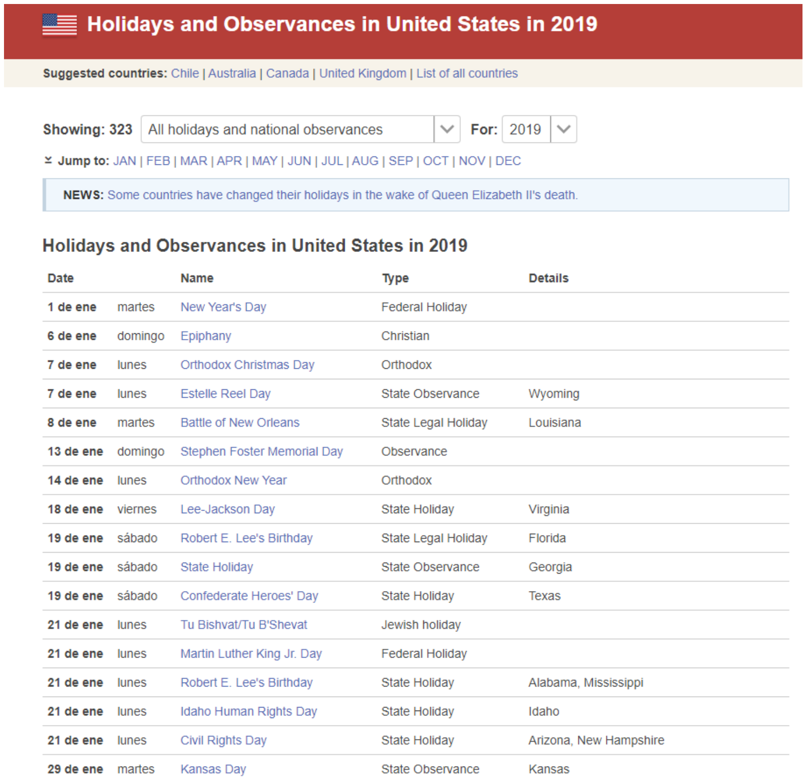
1. We use www.timeanddate.com as our main source of data. Inside this website, we scrape all holidays for each country available over the period 2000-2019. Figure A.1 shows holidays in the United States in 2019 as an example.

2. We collect information on whether the holidays are either local or national, keeping only the latter. To do that we use the third row in Figure A.1 to identify national/federal/public holidays. Whenever it is unclear if the holiday affects the whole country we click on the holiday and check specific information manually (see Figure A.2).[38]

3 Keep national/federal/public holidays and collapse by country and year.

[38]However, the website allows us to filter for public holidays despite different names across countries.

Figure A.1: Example of www.timeanddate.com



Holidays and Observances in United States in 2019

Suggested countries: Chile | Australia | Canada | United Kingdom | List of all countries

Showing: 323 All holidays and national observances **For:** 2019

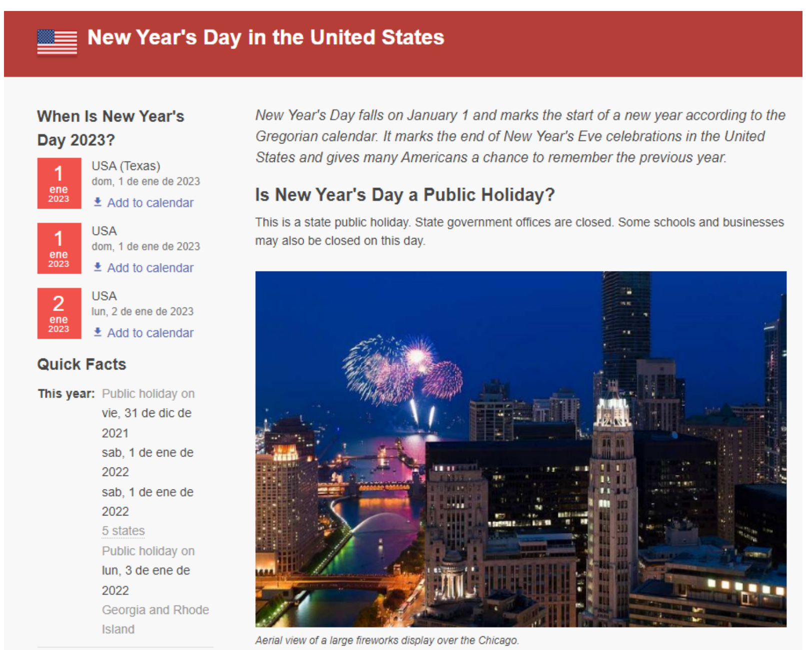
Jump to: JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC

NEWS: Some countries have changed their holidays in the wake of Queen Elizabeth II's death.

Holidays and Observances in United States in 2019

Date		Name	Type	Details
1 de ene	martes	New Year's Day	Federal Holiday	
6 de ene	domingo	Epiphany	Christian	
7 de ene	lunes	Orthodox Christmas Day	Orthodox	
7 de ene	lunes	Estelle Reel Day	State Observance	Wyoming
8 de ene	martes	Battle of New Orleans	State Legal Holiday	Louisiana
13 de ene	domingo	Stephen Foster Memorial Day	Observance	
14 de ene	lunes	Orthodox New Year	Orthodox	
18 de ene	viernes	Lee-Jackson Day	State Holiday	Virginia
19 de ene	sábado	Robert E. Lee's Birthday	State Legal Holiday	Florida
19 de ene	sábado	State Holiday	State Observance	Georgia
19 de ene	sábado	Confederate Heroes' Day	State Holiday	Texas
21 de ene	lunes	Tu Bishvat/Tu B'Shevat	Jewish holiday	
21 de ene	lunes	Martin Luther King Jr. Day	Federal Holiday	
21 de ene	lunes	Robert E. Lee's Birthday	State Holiday	Alabama, Mississippi
21 de ene	lunes	Idaho Human Rights Day	State Holiday	Idaho
21 de ene	lunes	Civil Rights Day	State Holiday	Arizona, New Hampshire
29 de ene	martes	Kansas Day	State Observance	Kansas

Figure A.2: Example of information on a specific holiday in the US



New Year's Day in the United States

When Is New Year's Day 2023?

1 ene 2023 — USA (Texas) — dom, 1 de ene de 2023 — Add to calendar

1 ene 2023 — USA — dom, 1 de ene de 2023 — Add to calendar

2 ene 2023 — USA — lun, 2 de ene de 2023 — Add to calendar

Quick Facts

This year: Public holiday on vie, 31 de dic de 2021 sab, 1 de ene de 2022 sab, 1 de ene de 2022 5 states Public holiday on lun, 3 de ene de 2022 Georgia and Rhode Island

New Year's Day falls on January 1 and marks the start of a new year according to the Gregorian calendar. It marks the end of New Year's Eve celebrations in the United States and gives many Americans a chance to remember the previous year.

Is New Year's Day a Public Holiday?

This is a state public holiday. State government offices are closed. Some schools and businesses may also be closed on this day.

Aerial view of a large fireworks display over the Chicago.

Holiday Selection Criteria. As the definition of a public holiday and its reach within local economies can significantly change across countries, we process data to keep holidays that widely affect local production. Given that www.timeanddate.com allows to filter for "official holidays and non-working days", we use that filter to keep only holidays with wide effects across the labor market. Table A.1 shows the holidays considered for our estimations. We kept all names as they appear on the data extracted from www.timeanddate.com. Given that names during the scraping process may differ across countries and periods, note that several entries of the table only present slight differences in the text. In addition, we consider holidays denoted as "half day" as 0.5 working days.

Table A.1: Types of Holidays on our Sample

Type	Freq.	Share	Cum. Share
Bank and government holiday	4	0.01	0.01
Bank holiday	222	0.49	0.5
De facto and bank holiday	40	0.09	0.59
De facto holiday	160	0.36	0.95
Federal holiday	223	0.49	1.44
Federal public holiday	269	0.6	2.04
Gazetted holiday	234	0.52	2.56
Government holiday	111	0.25	2.8
Half day	11	0.02	2.83
Half day holiday	62	0.14	2.96
Half-day	12	0.03	2.99
Joint holiday	63	0.14	3.13
National holiday	16,092	35.71	38.84
National holiday, Christian	1,034	2.29	41.14
National holiday, flag day	40	0.09	41.22
National holiday, Hebrew	221	0.49	41.71
National holiday, orthodox	391	0.87	42.58
National/legal holiday	81	0.18	42.76
Non compulsory payment holiday	40	0.09	42.85
Non-working day	3	0.01	42.86
Obligatory holiday	200	0.44	43.3
Official holiday	239	0.53	43.83
Private sector	21	0.05	43.88
Private sector holiday	104	0.23	44.11
Public holiday	25,162	55.84	99.95
Restricted holiday	2	0	99.95
Silent day, public holiday	20	0.04	100
Weekend	2	0	100

Notes: Definition intends to consider only holidays with national coverage.

Setting Holidays: The Case of the US. We now describe broadly how holidays are set in the US. First, it is important to note that even though there are roughly 10 federal holidays a year, it is not mandatory for the employer to give the employee the day off or pay premium pay for working on the designated holidays. Also, when fixed holidays (e.g. 4th of July) happen to occur on a weekend, there is a holiday "in lieu" of the previous working day, however, this usually applies only to the public workforce.

Overall, there are 10 federal holidays listed in Table A.2. Six of them, are always on a weekday. For instance, the birthday of Martin Luther King is commemorated as a federal holiday and takes place on the 3^{rd} Monday of January. On the other hand, variation in our data comes from the remaining 4 holidays which have a fixed date. For example, the 4th of July is always a federal holiday in the US, whether it is on a weekend or a weekday.

Table A.2: Regular Holidays in the US

Holiday	Date
New Year's Day	January 1^{st}
Birthday of Martin Luther King, Jr.	3^{rd} Monday in January
George Washington Birthday	3^{rd} Monday in February
Memorial Day	Last Monday in May
Independance Day	July 4^{th}
Labor Day	1^{st} Monday in September
Colombus Day	2^{nd} Monday in October
Veterans Day	November 11^{th}
Thanksgiving Day	4^{th} Thursday in November
Christmas Day	December 25^{th}

Despite that there are four holidays that are not linked to a specific day of the week, our data is able to capture the rescheduling of holidays in such cases. For instance, Table A.3 shows some examples of federal holidays in our data. There are two main takeaways from this table: (i) when a federal holiday ends on a weekend, authorities set an additional holiday on the closest working day (ii) Our data is able to capture it.

Table A.3: Some Examples of Holidays in the US

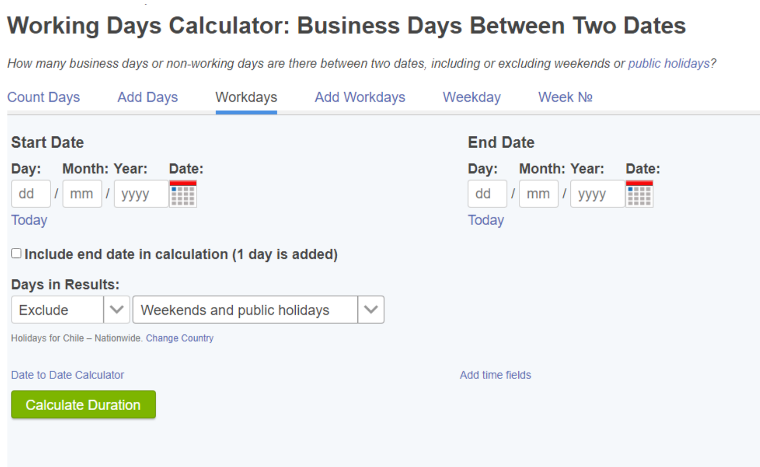
Holiday	Date	Day of the Week
Independence Day observed	July 3, 2015	Friday
Independence Day	July 4, 2014	Saturday
New Year's Day	January 1, 2017	Sunday
Day off for New Year's Day	January 2, 2017	Monday
Veterans Day observed	November 10, 2017	Friday
Veterans Day	November 11, 2017	Saturday

Source: www.timeanddate.com

Collecting Data on Workweek Schedule. Understanding the workweek-weekend schedule within countries is crucial for our identification strategy. Given that our identification relies on classifying holidays between a working day and a weekend, we need to be able to know how firms allocate resources within the week. In that sense, we also use web scraping to gather information regarding the broad definition of this schedule. However, while banks and schools usually have rigid 5-day schedules, that definition is not so clear for other sectors of the economy. This paper gathers data on weekend days across countries and thus identifies the working days each week. For example, the US typically works on a Monday thru Friday workweek, while Iran works from Saturday to Thursday.

Figure A.3 presents a snapshot of the date-to-date calculator of www.timeanddate.com. While this platform also allows us to directly extract working days, we prefer to combine workday schedule data from this source with a more comprehensive dataset of public holidays to construct working days.

Figure A.3: www.timeanddate.com date-to-date calculator



This approach has mainly three limitations. First, identifying countries' schedules is not trivial, and we often fail to gather reliable information on smaller countries' working days. Second, different sectors may have different workweek-weekend relations and some may even produce seven days a week.[39] Third, many countries (especially the poorer ones) have a 6-day workweek schedule, but it is not clear the overall production of the sixth day versus the other 5.

[39]For example, mining companies usually establish shifts among workers to keep production going all year.

B Additional Descriptive Exercises

B.1 Relation Between Annual Leave and Holidays

Given that countries set both public holidays and minimum annual leave, it may be interesting to see how countries allocate vacations between both tools. From a policy perspective, some may argue that more public holidays are preferred as they allow households to exploit strategic complementarities of leisure by having vacations on the same days. Conversely, others may argue that more working days alleviate firms as they can smooth labor throughout the year.

Panel (A) in Figure E.3 plots the cross-country relationship between the number of national holidays and the legal minimum of paid annual leave. Note that despite a concentration of national holidays around 15 days, there is a negative slope (-0.24, p-value$=0.02$). That is, there is some degree of substitution between annual leave regulation and national holidays. Moreover, income may play a role in the allocation between national holidays and annual leave. However, panels (B) and (C) in Figure E.3 show little correlation between national holidays and annual leave with income level (GDP per capita).

B.2 Benchmarking Holiday Effects with Public Health Interventions

As a benchmark from the public health literature, Concha-Barrientos et al. (2005) find that hazardous conditions in the workplace are responsible for a minimum of 312,000 fatal unintentional occupational injuries and 3.5 years of healthy life are lost per 1,000 workers every year globally. Further, Chandran et al. (2010) documents that deaths related to unintentional injuries are around 610 per million worldwide. That is, an average of $610 \div 250 = 2.44$ per working day, which is similar to the results presented in column (5) of Table 9.

Moreover, results in Rehm et al. (2003) suggest that unintentional injuries are likely to be driving alcohol-attributable mortality. Namely, they find that 32 percent of alcohol-related mortality is explained by unintentional injuries. Note however that while these results go in the opposite direction than ours, it is likely that unintentional injuries are not driven by alcohol-related mortality (i.e. the implication only goes one way).

Nevertheless, Vecino-Ortiz et al. (2018) argues that despite an overall decrease in injury-related mortality, this cause of death is becoming an increasingly prevalent cause of death among poorer countries. This may be relevant for our estimations as our panel of countries excludes (due to lack of data) several poor countries and thus, is exposed to downward bias. This paper also highlights different policy interventions and their estimated effects in reducing lives. We summarize the most important to compare with our results.

- Speed enforcement ($>$ 80000 lives saved per year).
- Drink-driving enforcement ($>$ 60000 lives saved per year).
- Formal swimming lessons for children younger than 14 years ($>$ 25000 lives saved per year).
- Crèches to supervise younger children (younger than 5 years; $>$ 10000 lives saved per year).

These estimates combined with our identification strategy allow us to get a better sense of how setting national holidays may affect yearly deaths. For example, using the economically active population (EAP) assumed in Concha-Barrientos et al. (2005) (2.9 billion people in the year 2000), results in column (5) of Table 9 shows that one additional working day (i.e. one national holiday that ends up on a weekend), increases yearly deaths per million people in approximately $3.47 \times 2900 = 10,063$.

C Identifying Changes in Holidays Regulations

This section explains the procedure for how to construct two dummy variables that allow us to control for policy changes in the number of holidays. In particular, one that tracks holidays not identified with respect to a benchmark year by name or date, and one that tracks changes in the number of "permanent" holidays with respect to the benchmark year. To compute these variables used in Section 5.3 we proceed as follows.

1. For the base period, count the number of holidays, excluding additional holidays in observance. Also, we store the name and date of each holiday.

2. For each period after the base period, we count the number of holidays, excluding additional holidays in observance. For each holiday, check if either the date or the name matches any holiday on the base period.

3. Define a dummy that takes the value 1 if the number of holidays in a given year does not match the number of holidays in the base period. Namely:

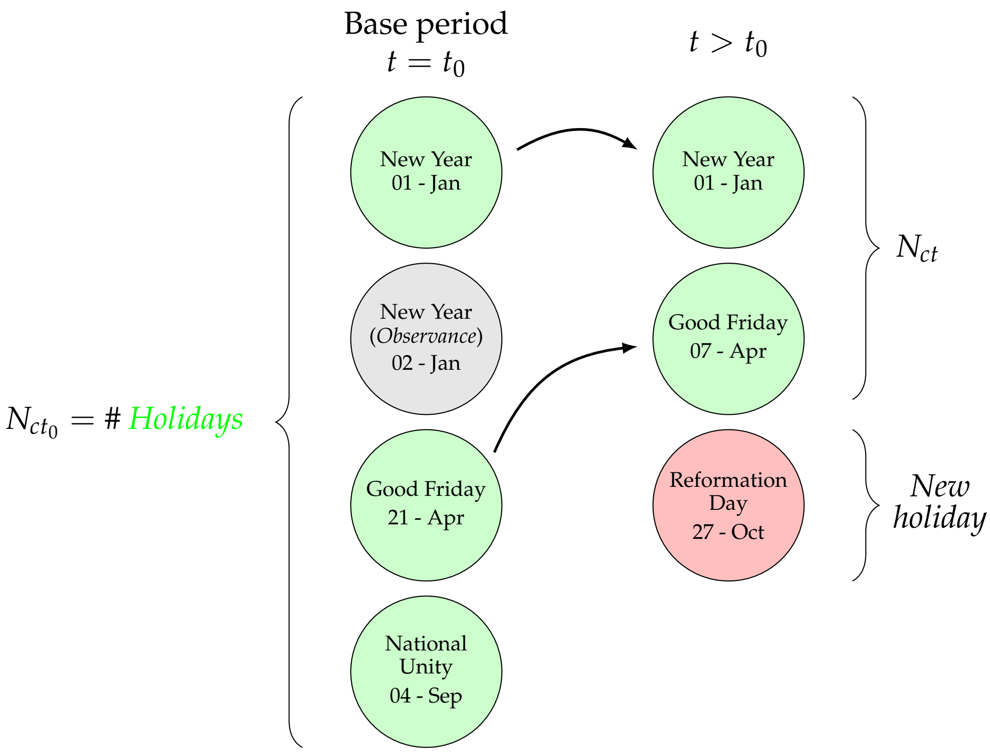
$$\text{Diff. } N \text{ of holidays}_{ct} = \mathbf{1}(\#\,\text{holidays}_{ct_0} \neq \#\,\text{holidays}_{ct}) \tag{C.1}$$

4. Define a dummy that takes the value one if there is at least one holiday in a year that does not match the name or date with any holiday in the base period. That is:

$$\text{No name/date match}_{ct} = \mathbf{1}\left(\#\text{ not matched holidays}_{ct} \geq 1\right) \tag{C.2}$$

Figure C.1 explains how we define the number of periods and the holidays considered for the base period. The figure presents a fictitious example to illustrate how we operate. Note that on $t = t_0$, there are four holidays, but we only count the three green ones, excluding an additional holiday observed "in lieu" of the original (gray circle). Then, on $t > t_0$, we match holidays either by date or name with the original holidays and compute the number of holidays excluding observances. This example shows that there is a new holiday (reformation day), thus the no-name/date match dummy will take the value 1, but the number of holidays is the same as in the base period, and therefore the dummy for the number of holidays will take the value 0.

Figure C.1: Identifying Policy changes



Notes: This figure illustrates an example of how we compute dummies for policy changes in Eqs. (C.1)-(C.2). Green circles denote holidays considered as existent in the base period. Gray circles denote transitory holidays set in response (or "in lieu") of another holiday. The red circle represents a holiday that does not match in date or name with any holiday in the base period t_0.

D Additional Tables

Table D.1: Main Variables and Data Sources

Variable	Source	Description
Holiday Variables		
Holidays	https://www.timeanddate.com/	Number of public holidays per year.
Non-Weekend holidays	https://www.timeanddate.com/	Number of public holidays that take place on a working day.
Working days	https://www.timeanddate.com/	Number of working days on a given year (given by Eq. (2)).
Saturday/Sunday	https://www.timeanddate.com/	Country-specific weekend days.
Growth Variables		
Real GDP (LCU)	IMF (WEO)	Local currency, constant prices
Real GDP (LCU), quarterly	IMF (IFS)	Quarterly GDP, local currency, constant prices
Sectoral Production	UNCTAD	Agriculture, industry and services. Constant 2015 US$
Terms of Trade Variables		
Price level of exports	PWT	Defined relative to the price level of USA in 2017
Price level of imports	PWT	Defined relative to the price level of USA in 2017
Labor-Related Variables		
Avg. Hours Worked	PWT	Average hours worked per year
Employment	PWT	Number of persons engaged (millions)
Paid annual leave	World Bank	Legal number of paid annual leave days.
Informality share	ILO	share of informal sector workers
Subjective well-being		
Happiness	World Value Survey	Dummy for respondents declaring being "quite happy" or "very happy"
Life Satisfaction	World Value Survey	Dummy for respondents declaring a life satisfaction greater than 5 (1-10 scale)
Health Variables		
Deaths	GBD	Number of deaths, all causes
Specific Deaths	GBD	Interpersonal violence, self-harm, transport injuries, unintentional injuries, and intentional homicides.

Table D.2: List of Countries Classified as Tax Havens

ISO3 Code	Country Name	ISO3 Code	Country Name
ABW	Aruba	LBN	Lebanon
AIA	Anguilla	LBR	Liberia
AND	Andorra	LCA	Saint Lucia
ANT	Netherlands Antilles	LIE	Liechtenstein
ATG	Antigua and Barbuda	LUX	Luxembourg
BHR	Bahrain	MAC	Macao
BHS	Bahamas	MAF	Saint Martin (French part)
BLZ	Belize	MCO	Monaco
BMU	Bermuda	MDV	Maldives
BRB	Barbados	MHL	Marshall Islands
COK	Cook Islands	MLT	Malta
CRI	Costa Rica	MSR	Montserrat
CUW	Curaÿcao	MUS	Mauritius
CYM	Cayman Islands	NIU	Niue
CYP	Cyprus	NLD	Netherlands
DJI	Djibouti	NRU	Nauru
DMA	Dominica	PAN	Panama
FSM	Micronesia, Federated States of	SGP	Singapore
GGY	Guernsey	SMR	San Marino
GIB	Gibraltar	SYC	Seychelles
GRD	Grenada	TCA	Turks and Caicos Islands
HKG	Hong Kong	TON	Tonga
IMN	Isle of Man	VCT	Saint Vincent and the Grenadines
IRL	Ireland	VGB	Virgin Islands, British
JEY	Jersey	VUT	Vanuatu
JOR	Jordan	WSM	Samoa
KNA	Saint Kitts and Nevis		

Source: Coppola et al. (2021)

Table D.3: Baseline Regression and Constrained Estimation

	Dependent Variable: GDP Growth	
	(1) Baseline	(2) Constrained
Δ log(working days)	0.17**	0.54***
	(0.078)	(0.075)
Country fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Observations	2,461	2,360
Countries	166	156
Adj. R^2	0.37	0.48

Notes: This table reports results from estimating Equation (3). Working days is constructed following Equation (2) and a country-specific definition of weekend days. The dependent variable is computed as a log-change in Real GDP (Local Currency). Column (1) present our baseline specification, while Column (2) does a constrained estimation assuming constant returns to scale (that is, $\alpha_L + \alpha_K = 1$ in our simple framework). All specifications include country and year fixed effects. Robust standard errors clustered at the country level. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

Table D.4: The Effect of a Public Holidays in Level on Output Growth

	Dependent Variable: GDP Growth	
	(1)	(2)
	One Day Change	Elasticity
Working Days (level or log)	0.0011***	0.27***
	(0.0004)	(0.09)
Country fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Observations	2,617	2,617
Countries	166	166
Adj. R^2	0.35	0.35

Notes: This table reports results from estimating $\Delta y_{ct} = \beta \log(\text{working days})_{ct} + \mu_c + \lambda_t + \varepsilon_{ct}$. Working days is constructed following Equation (2) and a country-specific definition of weekend days. The dependent variable is computed as a log-change in Real GDP (Local Currency). Column (1) presents extra days in level while Column (2) presents extra days in logs. All specifications include country and year fixed-effects. Robust standard errors clustered at the country level. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

Table D.5: Testing Relation Between Working Days, Employment and Hours

	Dependent Variable: $\Delta \log(\text{working days})$	
	(1)	(2)
$\Delta \log E$	0.01	
	(0.006)	
$\Delta \log h$		0.05
		(0.044)
Country fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Observations	2,468	357
Countries	163	19
Adj. R^2	0.08	0.20

Notes: This table reports results from estimating Equation (4). Working days is constructed following Equation (2) and a country-specific definition of weekend days. Employment data is taken from PWT and average hours worked from Bick et al. (2019). All specifications include country and year fixed effects. Robust standard errors clustered at the country level. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

Table D.6: The Effect of Holidays on Quarterly Growth

	Dependent Variable: quarterly GDP growth (Δy_t)	
	(1)	(2)
	Year-on-year	Quarter-on-quarter
Δ log(working days)	0.04*	0.01***
	(0.024)	(0.004)
Country fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Quarter fixed effects	Yes	Yes
Observations	4,015	4,192
Countries	58	58
Adj. R^2	0.43	0.16

Notes: This table estimates the baseline regression model but using quarterly data and year-over-year quarterly growth (i.e. $\Delta_4 y_t = \ln(Y_t) - \ln(Y_{t-4})$). The extra days variable is computed following Equation (2) but on a quarterly level. Column (1) presents extra days in level, while Column (2) presents extra days in logs. All specifications include country and date fixed effects. Robust standard errors clustered at the country level. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

Table D.7: Testing for the Effect of Potential Policy Changes — Year 2000 as Base Period

	Dependent Variable: GDP Growth		
	(1)	(2)	(3)
	No name/date match dummy	Diff. N of holidays	Both
Δ log(working days)	0.21**	0.22**	0.21**
	(0.09)	(0.08)	(0.09)
Country Fixed Effect	Yes	Yes	Yes
Year Fixed Effect	Yes	Yes	Yes
Observations	1,995	1,995	1,995
Countries	107	107	107
Adj. R^2	0.36	0.36	0.36

Notes: This table compares our baseline results with different specifications that control for permanent changes to the number of legal holidays. The table differs from Table 5 as it defined year 2000 as the base period for each country and thus drops all countries with initial year after 2000. Column (1) controls for a dummy that takes the value 1 if in a given year there is at least one holiday that does not match the date or name of any holiday in the base period. Column (2) controls for a dummy that takes the value 1 if the number of public holidays, excluding holidays "in lieu" (i.e. added to replace a holiday on a weekend) differs from the number of holidays in the base period (also corrected by holidays "in lieu"). Column (3) adds both dummies to the baseline regression. All specifications include country and year fixed effects. Standard errors in parentheses and clustered at the country level. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

Table D.8: Robustness: Controlling for Changes in Paid Annual Leave

	Dependent Variable: GDP Growth		
	(1)	(2)	(3)
Δ log(working days)	0.17**	0.17**	0.17**
	(0.079)	(0.079)	(0.079)
Paid annual leave (1-year tenure)	0.000		
	(0.001)		
Paid annual leave (5-year tenure)		0.001***	
		(0.000)	
Paid annual leave (10-year tenure)			0.001***
			(0.000)
Country fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Observations	2,068	2,068	2,068
Countries	161	161	161
Adj. R^2	0.39	0.40	0.40

Notes: This table presents estimates from Equation (3), but including controls for changes in paid annual leave. The constant term is not reported and all specifications country and year fixed effects. The dependent variable is computed as a log change in Real GDP (Local Currency). Data on changes in paid annual leave from the World Bank and available over the period 2004-2019. Standard errors are in parentheses and clustered at a country level. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

Table D.9: Robustness: Above/Below Median Informality Share

	Dependent Variable: GDP Growth	
	(1) Below median informality	(2) Above median informality
Δ log(working days)	0.22**	0.10
	(0.089)	(0.106)
Country fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Observations	783	939
Countries	57	56
Adj. R^2	0.33	0.38

Notes: This table presents estimates from Equation (3), but breaks the sample into above/below median informality share. Namely, it computes country average informality share and estimates the regression for countries that are above/below the median. Data on informality from ILO. The constant term is not reported and all specifications country and year fixed effects. The dependent variable is computed as a log change in Real GDP (local currency). Data on changes in paid annual leave from the World Bank and available over the period 2004-2019. Standard errors are in parentheses and clustered at a country level. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

Table D.10: Benchmarking the Magnitude of the Coefficient in Extra Days

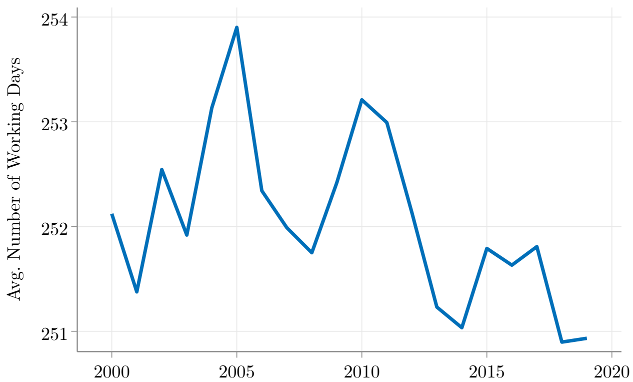
	Happiness		Life Satisfaction	
	(1)	(2)	(3)	(4)
Working days	-0.006**	-0.016***	-0.010	-0.014
% Divorced dummy coef.	4.82**	14.09***	7.78	15.21
% Working class dummy coef.	-	95.14	-	25.52
% income decile coef.	-	92.79***	-	38.99

Notes: This table presents the point estimate for our coefficient of interest Extra Days (row 1), in terms of the point estimate of control variables used in Equation (5) (rows 2-4). Divorced dummy coef. denotes the estimate with respect to being married and working class denotes the estimate with respect to being upper class. Columns (1)-(2) present results using the Happiness dummy as a dependent variable, while columns (3) and (4) present results for the life satisfaction dummy. (for detail please refer to table 8). Stars on rows 2-4 denote the significance of the coefficient ratio (computed using `nlcom` in STATA).

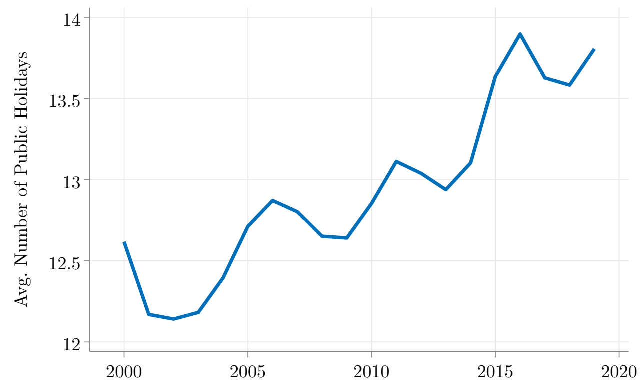
E Additional Figures

Figure E.1: Evolution of Public Holidays and Working Days

(A) Working days



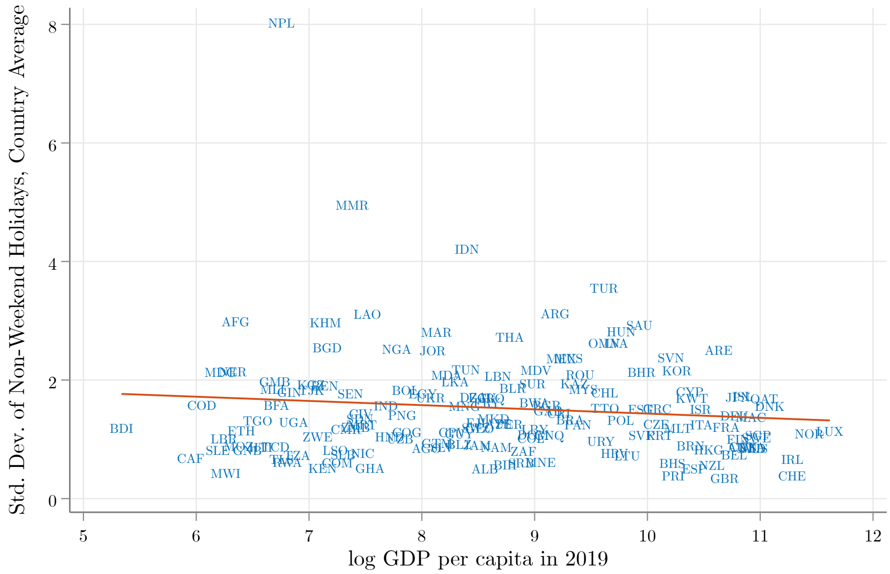
(B) Public holidays



(C) Cross-country changes in holidays

Notes: This figure presents the evolution of working days and public holidays in our baseline sample of countries. Panels A and B report time series for the cross-sectional average number of working days and holidays, respectively. Panel C reports the average number of holidays for each country in the periods 2000-2005 and 2014-2019. The dashed line denotes a 45 degree line.

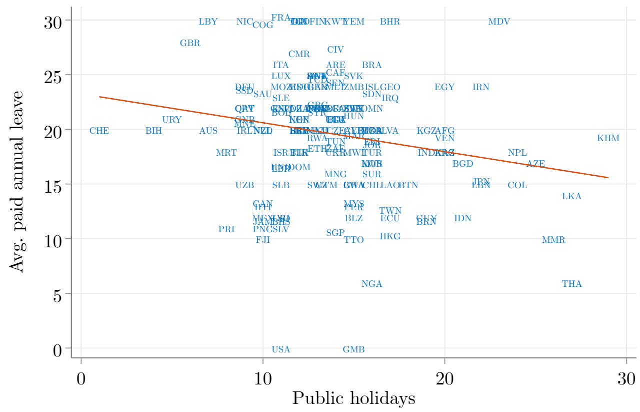
Figure E.2: Relation Between Volatility of Holidays and Income



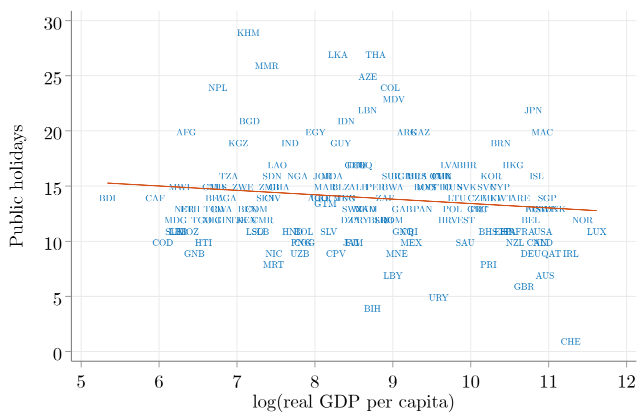
Notes: Real GDP per capita in 2010 $US. Results for the period 2000-2019. Slope = -0.07 and p value = 0.15

Figure E.3: Relation Between Annual Leave and Holidays

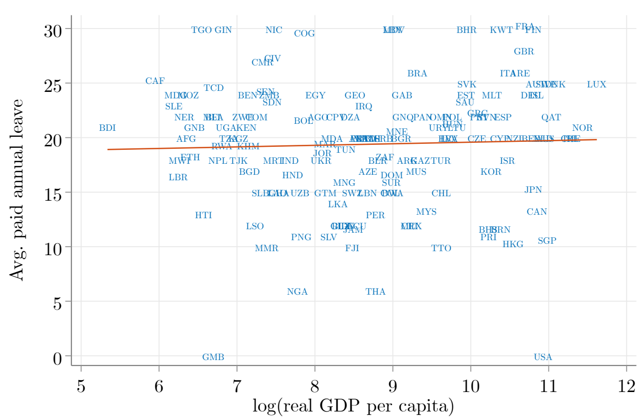
(A) Holidays and Paid Leave



(B) Holidays and Income



(C) Paid Leave and Income



Notes: All variables are reported at the end of our sample period (year 2019). The figure uses average paid annual leave data for workers with 1, 5, and 10 years of tenure (World Bank), real GDP per capita in 2010 US$, and yearly public holidays. Public holidays are measured in days according to our selection criteria. We drop Somalia as having substantially much more paid annual leave days than the rest of our sample (avg. of 80 days per year) due to workers being entitled to 15 days of paid vacation for each year of continuous service. For panel (A), the slope of the linear fit is −0.26 (SE 0.10). For panel (B), the slope is −0.40 (SE = 0.22). For panel (C), the slope is 0.14 (SE = 0.33).