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DISCUSSION PAPER

// EDUARD BRÜLL

Holy Days, Lost Days?

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Holy Days, Lost Days? *

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Abstract

Do public holidays meaningfully affect economic output? In Germany, strict Sunday laws create a unique natural experiment: when public holidays fall on Sundays, they typically do not additionally disrupt business activity. Exploiting this variation across states and years, I estimate the economic cost of a "lost" workday. Using monthly manufacturing data and a stacked event-study approach, I find that weekday holidays lead to modest but measurable reductions in output. Scaling the estimates implies annual GDP losses between 0.06% and 0.28%, depending on whether the effect is assumed to apply only to manufacturing or to the whole economy.

Keywords: Public holidays, Labor supply, Natural experiment, Germany
JEL codes: E23, J22, H24, H75

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1 Introduction

In 2023, the Danish government abolished the public holiday Store Bededag (Great Prayer Day) to help fund increased defense spending, citing the need to boost labor supply. Nearly thirty years earlier, Germany eliminated Buß- und Bettag (Day of Repentance and Prayer) in most states to support long-term care insurance. In France, following the deadly 2003 heatwave, Lundi de Pentecôte (Pentecost Monday) was controversially reclassified as a working day to finance long-term care. Each of these decisions triggered fierce public debates over the costs and benefits of public holidays — both economic and symbolic. Do such days meaningfully reduce productivity, or are they culturally valuable holidays with limited macroeconomic cost?

This paper provides a within-country, quasi-experimental estimate of the short-run output cost of paid national holidays. Specifically, I study a setting in which some holidays are, by design or coincidence, economically ineffective. In Germany, nearly all commercial activity ceases both on Sundays and public holidays due to stringent legal restrictions on work, enshrined not only in statutory law but also in the constitution.[1] As a result, when a public holiday coincides with a Sunday, it does not generate additional reductions in production or consumption.

Since many holidays rotate across weekdays and are not uniformly observed across federal states, this creates quasi-random variation in the "effective" number of holidays.[2] I exploit this variation to estimate how manufacturing revenues respond when a holiday falls on a Sunday. If a holiday falling on a Sunday produces no output drop, but the same holiday on a weekday does, the difference identifies the economic cost of the day off. This design echoes the logic in Montero and Yang (2022), though the variation here arises from institutional overlap (Sunday rest $\times$ public holiday), not the agricultural cycle.

A long-standing literature emphasizes how institutions shape aggregate labor supply and productivity. For example, Alesina, Glaeser, and Sacerdote (2005) attribute cross-country differences in working hours to social norms and institutions, and Prescott (2004) highlight the role of labor-income taxation. More recent work examines short-run variation in time away from work. Lee, Kawaguchi, and Hamermesh (2012) show that mandated reductions in hours are largely reallocated to leisure, while Montero and Yang (2022) document persistent income losses from religious festivals overlapping with harvest periods.

[1] Sunday and holiday rest is protected under Article 140 of the Basic Law (Germany's constitution). This principle is implemented through the Working Hours Act (Arbeitszeitgesetz, §9), which prohibits most forms of work both on Sundays and public holidays, and the Continued Remuneration Act (Entgeltfortzahlungsgesetz, §2), which mandates full pay for employees on these non-working days. These legal guarantees stand in stark contrast to the United States, where Sundays are generally unrestricted and public holidays do not require (private) employers to provide paid leave.

[2] Appendix Figure A.1 shows that moving public holidays are approximately evenly distributed across weekdays, supporting the assumption of quasi-random timing.

A related set of studies focuses on how holiday timing affects economic activity in consumer and labor markets. For instance, Basker (2005) shows that a longer U.S. Christmas shopping season raises retail sales, Urbatsch (2013) finds that earlier Thanksgivings increase November employment, and Strielkowski (2013) discusses the commercial potential of culturally driven holidays such as Halloween. These papers highlight the sensitivity of output and employment to the calendar but do not provide causal estimates of the productivity cost of paid holidays.

My paper is most closely related to empirical studies that use policy variation to assess how working-time regulations affect productivity and health. Previous research has analyzed the effects of liberalizations of Sunday trading laws (Danchev and Genakos (2015)), restrictions on shop opening hours (Paul (2015)), or historical introductions of weekly working-hour caps (Prodromidis, Karlsson, and Kühnle (2025)). I extend this literature by quasi-experimentally identifying the output cost of paid holidays within one country using an explicit inactive-holiday counterfactual built into German law.

Closest in spirit, Rosso and Wagner (2022) exploit weekend-falling holidays in a global panel (2000–2019) and estimate a working-day elasticity of GDP around 0.2, implying roughly 0.08% lower annual GDP per holiday, with stronger effects in manufacturing. My study complements theirs by (i) leveraging Germany's constitutionally enforced Sunday rest to define inactive holidays; (ii) using monthly state-level manufacturing outcomes and hours to link inputs and outputs; and (iii) providing stacked event-study diagnostics. Consistent with their macro elasticity, my conservative aggregation implies a whole-economy effect of about 0.06% of GDP per holiday, with an upper bound of ~0.28%.

To study the impact of public holidays on productivity, I combine three pieces of evidence. First, I use monthly state-level data from the monthly survey of manufacturing establishments by the German Federal Statistical Office (2023) to estimate how Sunday holidays affect real per capita revenue and working hours. Second, I validate these estimates through a stacked event-study that compares outcomes across holiday-year cohorts, offering transparent pre-trend diagnostics. Finally, I simulate the aggregate macroeconomic effect using posterior draws from the baseline estimates and Germany's GDP composition. Together, the results suggest that holidays reduce economic activity modestly but measurably, with estimated annual output effects of up to 0.3%, depending on assumptions about sectoral incidence.

2 Data and Empirical Strategy

2.1 Data

To implement my analysis, I rely on monthly panel data from the Cost Structure Survey of Manufacturing Establishments conducted by the German Federal Statistical Office (2023), covering all 16 federal states from 2005 to 2019. I focus on two outcomes: real revenue per employee and total working hours, both aggregated at the state-month level. Since the data are restricted to the manufacturing sector, they provide a consistent and well-measured proxy for actual production activity.

Public holiday dates are compiled from official state calendars and mapped to their weekday occurrence and state-level observance. In Germany, several holidays occur on fixed calendar dates (e.g., the Reunification Day on October 3rd), causing them to rotate across weekdays over time. Some (religious) holidays are celebrated only in a subset of states over the whole sample period, such as *Allerheiligen* (All Saints' Day), *Heilige Drei Könige* (Epiphany), or *Mariä Himmelfahrt* (Assumption of Mary), providing additional cross-sectional variation.

2.2 Empirical strategy

The key explanatory variables are the number of public holidays in a given month that fall on a Sunday (*SundayHolidays*) and the total number of public holidays that month (*TotalHolidays*). The estimating equation is:

$$\log(y_{smt}) = \beta \cdot \text{SundayHolidays}_{smt} + \delta \cdot \text{TotalHolidays}_{smt} + \alpha_s + \gamma_t + \mu_m + \varepsilon_{smt}, \quad (1)$$

where y_{smt} denotes either log real revenue per employee or log total working hours in state s, calendar month m, and year t. The model includes fixed effects for states (α_s), calendar years (γ_t), and calendar months (μ_m), and clusters standard errors at the state-year-month level. A positive coefficient on *SundayHolidays* suggests that months with more "inactive" holidays — holidays that fall on a Sunday and therefore do not reduce output — are associated with higher productivity. This reflects the implicit gain from not "losing" a workday to a holiday.[3]

[3] All regressions in this article are computed using R and the *tidyverse* package ecosystem (Wickham et al. (2019)) as well as *fixest* (Bergé (2018)) and *modelsummary* (Arel-Bundock (2022)).

2.2.1 Stacked Event Study Design

To validate the identifying assumptions and assess dynamic effects, I implement a stacked event-study that exploits the quasi-random timing of state and national holidays falling on Sundays. The design compares economic outcomes across different event years within the same calendar month and state, isolating the moment when a specific holiday no longer reduces output because it falls on a Sunday.

The analysis proceeds in three steps. First, I identify all holidays that rotate across weekdays and are observed in at least one federal state in multiple years. For each holiday–state–year combination in which the holiday falls on a Sunday, I define a treatment cohort. Each cohort corresponds to a specific event year when a given holiday in a given state becomes economically inactive due to its coincidence with a Sunday.

Second, I construct a balanced panel of ± 4 years around each cohort's treatment year. For each observation in this panel, I generate an event-time variable $k = \text{year} - \text{event\_year}$ and a binary indicator *HolidayMonth*, which equals one in the month the holiday typically occurs and zero otherwise. This isolates variation within the holiday's calendar month across time.

Third, I estimate the following specification:

$$\log(y_{smct}) = \sum_{k=-4,\, k\neq -1}^{+4} \beta_k \cdot \mathbf{1}\{\text{period} = k\} \times \text{HolidayMonth}_{smct} + \alpha_s + \mu_m + \lambda_k + \delta_c + \varepsilon_{smct}, \quad (2)$$

where $\log(y_{smct})$ denotes log real revenue per capita in state s, month m, and cohort c at event time k. The model includes fixed effects for states (α_s), calendar months (μ_m), event-time (λ_k), and event cohorts (δ_c), and clusters standard errors at the event cohort level.

This setup isolates the effect of "losing" a holiday within a given calendar month, while controlling for seasonality, national economic cycles, and holiday-specific shocks. The coefficients β_k trace out the dynamic response of output in the holiday month relative to the reference year ($k = -1$), the last year before the holiday falls on a Sunday. Importantly, coefficients for pre-treatment years ($k < 0$) provide a transparent test of the parallel trends assumption, while β_0 captures the immediate revenue effect of the holiday becoming economically inactive.

2.3 Posterior Simulation

To assess the macroeconomic significance of the estimated effects, I simulate from the posterior distribution of the coefficient $\hat{\beta}$ on *SundayHolidays* from the main specification. I draw 20,000 samples from a normal distribution with mean and standard error corresponding to the point estimate and robust standard error of the baseline regression. Each draw is converted into an annualized percentage change by dividing the monthly effect by 12. I report results under two assumptions. First, I assume the treatment effect applies uniformly across the entire economy. Second, I restrict the effect to apply only to the manufacturing sector, since the estimates are derived from revenue and labor input in that sector. This yields a conservative lower bound on the output effect, concentrating only on the 20% of German GDP for which the effect is directly identified. In addition I scale the effect by German GDP in 2023 to obtain an estimate for output loss in Germany in euros.

3 Results

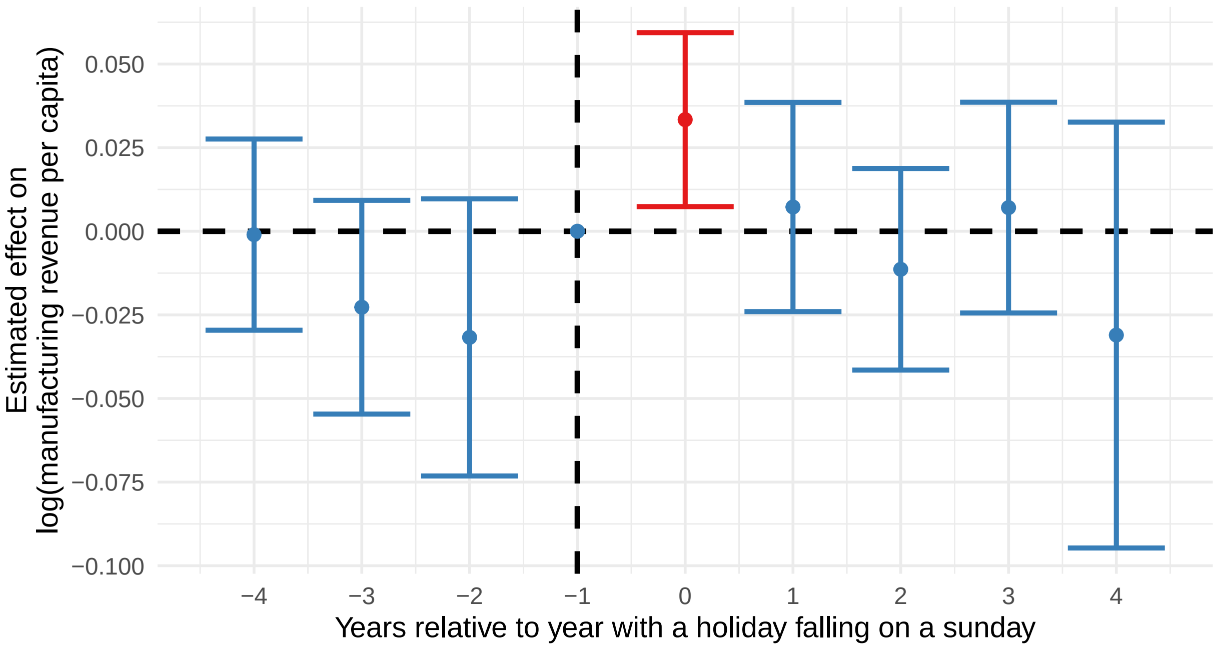
Table 1: Regression for the Effects of Sunday Holidays on Manufacturing Output

	(1) **Log Revenue**	(2) **Log Revenue**	(3) **Log Working Hours**	(4) **Log Working Hours**
Sunday Holidays	0.024	0.032**	0.016	0.026***
	(0.014)	(0.012)	(0.012)	(0.008)
Total Holidays		-0.028***		-0.035***
		(0.004)		(0.002)
State FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Calendar Month FE	Yes	Yes	Yes	Yes
N	2,880	2,880	2,880	2,880
R^2	0.915	0.916	0.996	0.997

Notes: Each column reports coefficients from fixed-effects regressions using monthly state-level data from the German manufacturing sector (2005–2019). The dependent variable is log real manufacturing revenue per employee in columns (1)–(2), and log total working hours in columns (3)–(4). The key explanatory variable, Sunday Holidays, counts the number of public holidays in a given month that fall on a Sunday. Total Holidays captures the total number of holidays (weekday and Sunday) in that month. All models include fixed effects for calendar month, calendar year, and state. Standard errors are multi-way clustered by state, calendar year, and calendar month and reported in parentheses. Significance levels: p<0.1 (*), p<0.05 (**), p<0.01 (***).

Table 1 shows the results of fixed-effects regressions estimating the impact of Sunday holidays on manufacturing output based on equation 1. Columns (1) and (2) show results for log revenue per employee as the outcome, while columns (3) and (4) present results for log total working

Figure 1: Stacked Event Study for the Effect of a Sunday Holiday



Notes: This figure shows estimated effects of a holiday falling on a Sunday on log manufacturing revenue per capita, using a stacked event-study design. Each point represents the estimated difference in revenue in the holiday month, relative to the year immediately before the holiday first coincides with a Sunday (event time = −1). The red point at event time 0 captures the immediate effect of the holiday becoming economically inactive. Pre-treatment estimates are close to zero, supporting the parallel trends assumption. Error bars indicate 95% confidence intervals, with standard errors clustered at the event cohort level.

hours. In both cases, the coefficient on *SundayHolidays* is positive, indicating higher output and labor input when holidays fall on Sundays and thus do not interrupt weekday production. The effect becomes larger and statistically significant once Total Holidays is included as a control (columns 2 and 4), confirming that weekday holidays also depress activity. This pattern is expected: months with several holidays both increase the probability that one falls on a Sunday and reduce output through weekday holidays, so including *TotalHolidays* separates the general holiday effect from the specific "inactive holiday" effect. The magnitude is similar across outcomes: Sunday holidays raise revenue by about 3% and working hours by 2.6% in the fully specified models, suggesting these gains reflect real preservation of workdays.

To interpret these estimates in terms of macroeconomic relevance, consider the coefficient on Sunday Holidays from column (2), which implies that each additional holiday falling on a Sunday raises monthly revenue per employee by 3.2%. Annualizing this monthly effect yields an approximate yearly gain of 0.27% in manufacturing output per employee, assuming a uniform distribution of such holidays throughout the year. A similar calculation for working hours, using the 2.6% coefficient from column (4), implies an annual increase of roughly 0.22% in total hours worked.

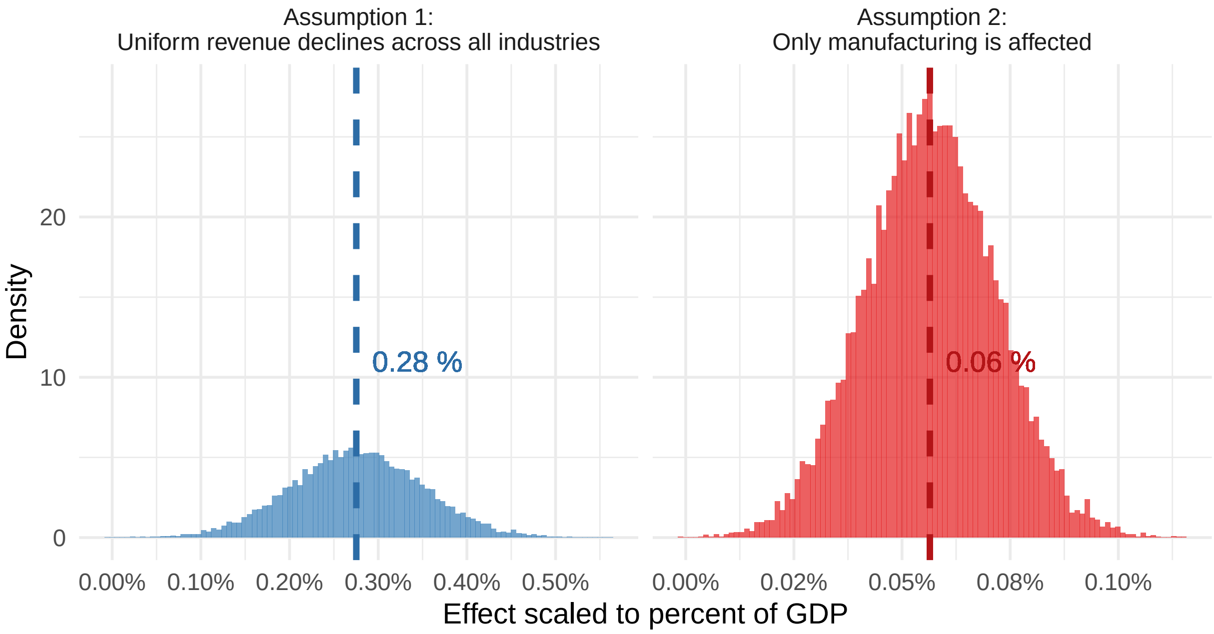
Figure 1 presents results from a stacked event-study design based on equation 2 to validate the results from table 1. The specification compares manufacturing revenue in the month a holiday occurs across ± 4 years around the year it falls on a sunday, controlling for state, calendar-month, and holiday-type-event-year cohort. The coefficient at event time 0 captures the immediate shift in output when a holiday falls on a Sunday.

The estimated effect at event time 0 is positive and statistically significant and falls in the same range suggested by the estimates in Table 1. Notably, the point estimate also suggests a roughly 3% increase in monthly output for years with a Sunday holiday. Pre-treatment coefficients are small and not significantly different from zero, supporting the assumption of parallel trends. The slight dip at event time −2 likely reflects holidays falling on Fridays, which are more disruptive to production compared to the reference year (−1) which corresponds to Saturday holidays. Saturdays are already partial non-working days in many firms, thus attenuating the baseline effect. This weekday pattern helps explain why some pre-treatment coefficients trend slightly negative, even though they are not statistically significant. Post-treatment effects remain modest and statistically indistinct, consistent with a one-time gain from avoiding the temporary loss of a working day rather than any lasting trend.

4 Macroeconomic Relevance: Posterior Simulation

To translate the estimated monthly revenue effects into macroeconomic terms, I simulate the implied annual GDP gain from avoiding a single working-day holiday. Figure 2 shows the distribution of GDP effects under two alternative assumptions. The first assumes the estimated revenue effect applies uniformly across all sectors of the economy, while the second restricts the effect to manufacturing alone. These two assumptions provide upper and lower bounds for the likely aggregate effect: the full-economy assumption likely overstates the true impact by applying manufacturing-based estimates to all sectors, while the manufacturing-only assumption likely understates it by ignoring potential spillovers to related industries. Both scenarios are based on 20,000 posterior draws from the main estimate in column (2) of Table 1.

Figure 2: Posterior Simulation for the Implied Effect on GDP



Notes: This figure shows simulated GDP effects based on 20,000 posterior draws of the estimated revenue gain from a holiday falling on a Sunday. Under Assumption 1 (left panel), the effect is extrapolated to the entire economy, assuming revenue effects are uniform across sectors. Under Assumption 2 (right panel), the effect is restricted to the manufacturing sector, which accounts for roughly 20% of GDP. Vertical dashed lines indicate posterior medians. The median estimated gain is 0.28% of GDP under Assumption 1 and 0.06% of GDP under Assumption 2.

Under the assumption that revenue losses are evenly distributed across all sectors, the median gain amounts to roughly 11.3 billion euros, or 0.28 % of GDP. If the effect is limited to manufacturing (which comprises 20 % of GDP), the median gain drops to about 2.3 billion euros, or 0.055 % of GDP. The simulated distributions are relatively narrow: even the upper bound of the 90 % credible interval does not exceed €17.7 billion in the full-economy case or €3.6 billion in the manufacturing-only case.

To better gauge the economic plausibility of large effects, I examine posterior probabilities for a range of GDP thresholds. Under the uniform-impact assumption, there is a 95 % probability the gain exceeds 0.1 % of GDP, but only a 1 % probability it exceeds 0.5 %. The bulk of the posterior mass (over 75 %) lies between 0.2 % and 0.4 % of GDP. In contrast, under the manufacturing-only scenario, the effect is very likely below 0.1 % of GDP, with virtually zero probability of reaching 0.2 %. These results suggest that the cost of lost working days is economically meaningful but bounded. It is rarely large enough to exceed 0.3 % of GDP, yet robustly different from zero.

Compared to the mechanical benchmark of 0.4% ($\approx$ 1/250 workdays), the 0.28% upper bound indicates partial intra-month reallocation of activity through overtime, shift smoothing, or other forms of intertemporal adjustment. The manufacturing-only estimate (0.06%) is close to the benchmark implied if only manufacturing were affected ($\approx$ 0.08%).

5 Conclusion

This paper estimates the manufacturing output loss in German states when holidays fall on Sundays versus weekdays. The results show that Sunday holidays are associated with a roughly 3% increase in monthly revenue per employee, consistent with the idea that avoiding a workday disruption yields modest but measurable gains. Scaling this effect to the national level suggests that removing one public holiday could raise annual GDP by up to 0.3%, depending on whether the effect is limited to manufacturing or assumed to generalize across sectors.

While these results point to a real output cost of public holidays, they should not necessarily be interpreted as a general argument for abolishing them. First, the analysis focuses solely on production effects and does not capture potential long-term benefits of personal days, such as improved health or well-being (e.g. due stronger social connectedness as documented in Merz and Osberg (2006)). Second, the estimates are specific to manufacturing and may not apply to service sectors with different scheduling flexibility. The output loss from a holiday is real, but likely modest enough to leave room for broader social considerations in policy design.

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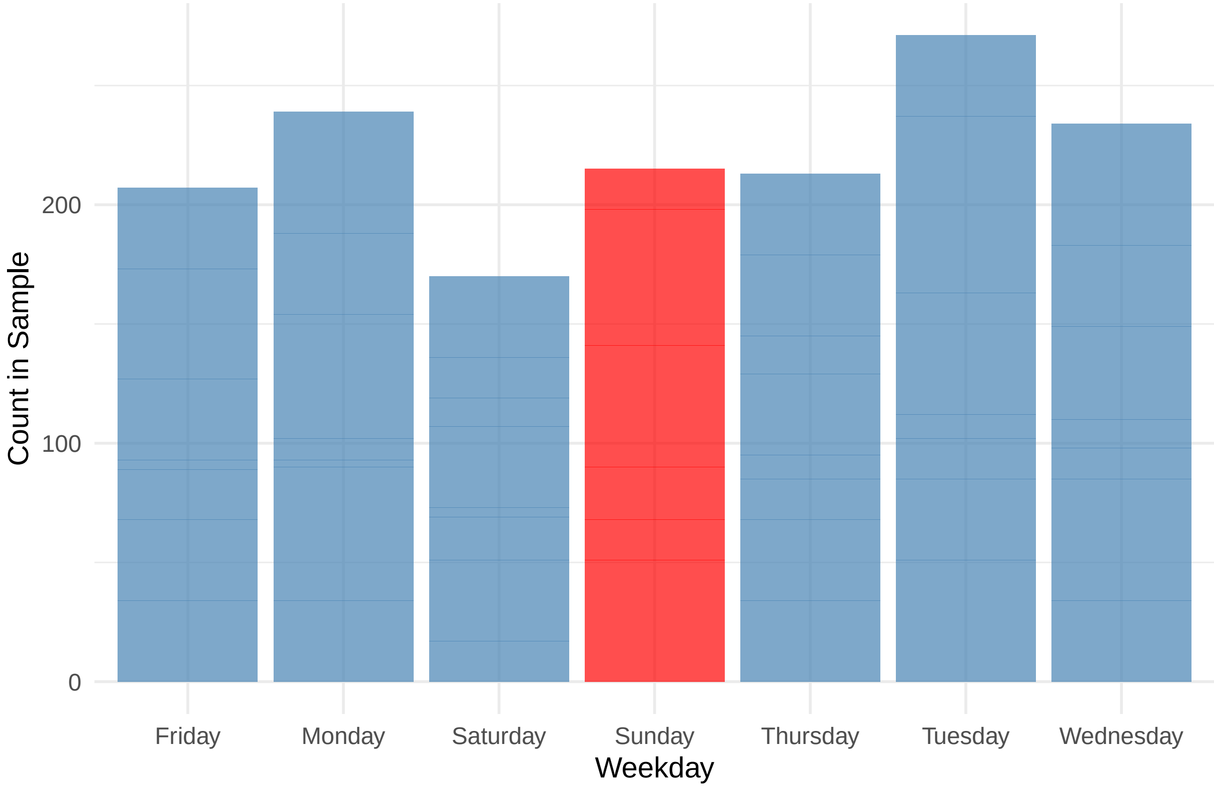
Appendix

Figure A.1: The Distribution of Moving Public Holidays over Weekdays in Germany



Notes: This figure shows the distribution of all moving public holidays in the sample (2005–2019) across weekdays. "Moving" holidays are those that fall on different weekdays in different years and are observed in at least one German federal state more than once. The near-uniform distribution confirms that the weekday on which a holiday falls is quasi-random over time, supporting the identification strategy that compares holidays falling on Sundays versus weekdays.

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