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Hours Worked in Europe and the US: New Data, New Answers*

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Abstract

We use national labor force surveys from 1983 through 2011 to construct hours worked per person on the aggregate level and for different demographic groups for 18 European countries and the US. We find that Europeans work 19% fewer hours than US citizens. Differences in weeks worked and in the educational composition each account for one third to one half of this gap. Lower hours per person than in the US are in addition driven by lower weekly hours worked in Scandinavia and Western Europe, but by lower employment rates in Eastern and Southern Europe.

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1 Introduction

An active recent literature has documented large differences in the levels and trends of aggregate hours worked per person across OECD countries, and specifically lower aggregate hours worked per person in Europe than in the US. This literature traces these lower hours in Europe back to, amongst others, labor income taxation (e.g., [Prescott \(2004\)](#), [Rogerson \(2006\)](#), [Olovsson \(2009\)](#), [McDaniel \(2011\)](#), to name a few), institutions ([Alesina et al. \(2005\)](#)), and social security systems ([Erosa et al. \(2012\)](#), [Wallenius \(2013\)](#), [Alonso-Ortiz \(2014\)](#)). One basic step to understand the causes of the large differences in labor supply is to analyze, first, whether these differences exist for all margins of labor supply, and, second, how much they are driven by different characteristics of the population. Are fewer Europeans working, or do they work fewer hours per work week, or do they simply enjoy more vacation days? Are the aggregate differences driven by different sectoral compositions across countries, different age compositions, or different educational compositions? These questions have been raised early on in [Rogerson \(2006\)](#) as an important avenue for advancing the research agenda on understanding differences in hours worked across countries, but could only be answered to a limited extent based on existing data readily available to researchers.

This paper documents differences in hours worked per person between the US and 18 European countries based on “new data” compiled from national labor force surveys.¹ Constructing internationally comparable hours estimates based on labor force surveys allows us to decompose differences in hours per person into the different components of labor supply, namely employment rates, weeks worked per year, and weekly hours worked per employed, and to analyze to which extent these differences are driven by different demographic and sectoral compositions. This paper thus provides a careful statistical decomposition of the hours differences between Europe and the US. The resulting facts open up new avenues for research. We use three different labor force surveys, namely the European Labor Force Survey, the US Current Population Survey, and the German Microcensus, covering the time period 1983 to 2011. First, we describe how we measure employment rates and hours worked per employed in a consistent way that leads to comparable hours worked per person estimates across countries. Next, we document that differences in *aggregate* hours worked per person between Europe and the US are substantially larger in our data

¹[Ohanian and Raffo \(2012\)](#) also add new evidence on the measurement of hours worked across OECD countries by constructing hours measures at the quarterly frequency. [Bick et al. \(2016\)](#) measure hours worked for 81 countries in the early 2000s focusing on the differences between low-, middle- and high-income countries rather than the differences among the high-income countries as we do here. [Burda et al. \(2008\)](#), [Burda et al. \(2013\)](#), [Fang and McDaniel \(2016\)](#), and [Bridgman et al. \(2016\)](#) construct cross-country hours worked measures using time-use surveys. The advantage of time use surveys is the precise measurement of time spent over an entire work day or weekend day. The disadvantage – particularly in comparison to labor force surveys – is the much lower frequency and much smaller sample size.

than in the National Income and Product Accounts (NIPA) data. We analyze the reasons for this discrepancy, and show implications for the measurement of labor productivity differences and for the performance of macroeconomic models that explain the cross-country differences through taxation ([Prescott \(2004\)](#)). We then address the core question of this paper and show that differences in weeks worked over the year account for one third to one half of the Europe-US hours gap, and a further one third to one half are explained by differences in the educational composition across countries. Lower hours per person in Scandinavia and Western Europe than in the US are in addition driven by lower weekly hours worked, whereas lower hours per person in Eastern and Southern Europe are in addition driven by lower employment rates. Hence, the “new answers” we provide refer both to different evidence on *aggregate* hours worked per person than the one provided by NIPA data, and more importantly to the disaggregate evidence that cannot be obtained from aggregate NIPA data. We make the data available on our webpage to the research community.

The measurement of hours worked per person, employment rates, and hours worked per employed from labor force surveys is not trivial. First, the main difference between the several surveys, at a given point in time across countries or for a given country over time, regards the sampling of reference weeks over the year. The reference weeks range from one specific week only, to a quarter, to the sampling of all 52 weeks of the year. We document that this is not a major problem for the consistent measurement of employment rates, but that without any further adjustment hours worked per employed, which exhibit a fair amount of seasonality, are not measured consistently. Second, we show that even if all 52 weeks of the year are covered, vacation days are severely underestimated in the labor force surveys, partly because not all weeks are sampled with equal probability. We implement a measurement strategy of hours worked per employed that is able to deal with both these issues by adjusting for vacation days, i.e. annual leave and public holidays, obtained from external data sources. It turns out that this also drastically decreases the problem of seasonality in hours worked per employed, which is mostly driven by vacation days.

As is common practice when working with micro data sets, see e.g. the 2010 Review of Economic Dynamics special issue on “Cross Sectional Facts for Macroeconomists” ([Krueger et al. \(2010\)](#)), we compare our (LFS) aggregate statistics on hours worked per person with those from the National Income and Product Accounts (NIPA), which are provided by the OECD “National Accounts Database” and the Conference Board’s “Total Economy Database” (TED). For most countries and years, the numbers by the OECD and TED coincide, but the time-series available from TED is longer than the one from the OECD. While time trends for hours are similar in LFS and NIPA data, cross-country estimates show substantial level differences between both data sets. LFS data indicate that Europeans work 19% fewer hours than Americans in the recent pre-crisis

years 2005-2007, while NIPA data only imply a difference of 7%. We proceed by investigating the sources of these large differences between LFS and NIPA data. We find that these mainly arise from the fact that the national statistical agencies use vastly different kinds of data sets and methods to construct hours estimates. As a consequence, the OECD itself cautions that their data are not suitable for cross-country comparisons. In contrast, we use always the same kind of data source, namely labor force surveys, to construct hours worked estimates, and apply exactly the same algorithm to all data sets, thereby maximizing the comparability across countries. A further advantage of the LFS data are that they are not subject to major revisions like the NIPA data.

We find that it matters for macroeconomic analyses whether one relies on LFS or NIPA data. First, we analyze implications for labor productivity differences between Europe and the US. Based on LFS data, Europe looks with 86% of the US level closer to the US in terms of labor productivity than with 78% based on NIPA data. This is mostly driven by the narrowing of the rather small labor productivity gap to the US for Western Europe by three fourths, and the large gap for Southern Europe by one third in LFS data compared to NIPA data, while differences in productivity measurement between the different data sets are smaller for Eastern Europe and Scandinavia. Second, we show, relying on the work by [Prescott \(2004\)](#), that through the lens of a neo-classical growth model average tax rate differences and differences in the consumption/output ratios can account for 52 percent of the differences in hours worked between Europe and the US if these are measured based on LFS data, as opposed to more than 100 percent if they are measured by NIPA data. Thus, the explanatory power of taxes for the Europe-US hours gap is smaller when relying on LFS data than when relying on NIPA data.

After documenting these differences in *aggregate* hours worked per person between LFS data and NIPA data, we turn to the core question of the paper and provide a decomposition of hours worked differences between Europe and the US for the recent pre-crisis years 2005 to 2007, focusing on individuals aged 15 to 64. We first document that employment rates and weekly hours worked are strongly negatively correlated across countries. By contrast, the number of work weeks during the year is uncorrelated with both hours worked per week and employment rates. All European regions (Scandinavia, Western Europe, Eastern Europe, and Southern Europe) have on average similar hours that are 16 to 19% lower than in the US. While weeks worked are uniformly substantially lower in Europe than in the US, in Southern and Eastern Europe lower hours are additionally driven by lower employment rates, but in Western Europe and Scandinavia by fewer hours worked per work week. The other component of labor supply always points in the opposite direction: individuals in Southern and Eastern Europe work longer weekly hours than US citizens, and individuals in Scandinavia and to some extent Western Europe are more likely to be employed

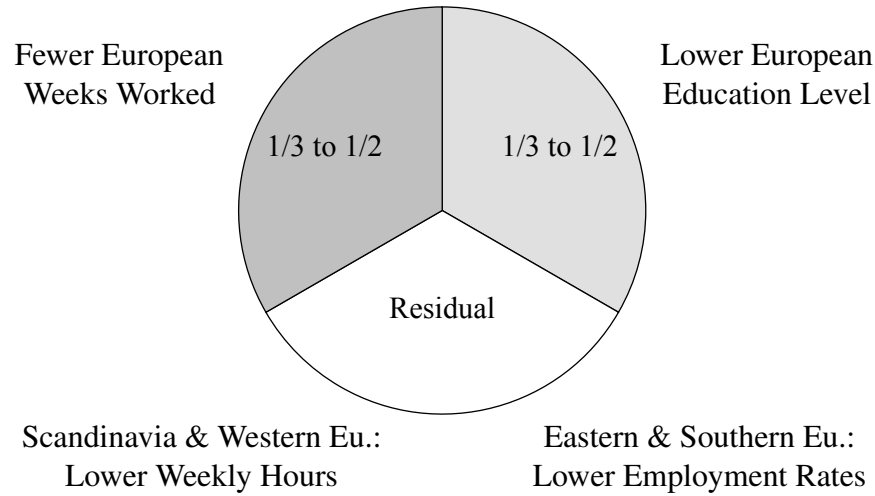
than US citizens.

Exploiting the rich micro-structure of our data, we then ask which role differences in the demographic and sectoral composition between the US and different European countries play in accounting for these differences. For instance, if older people worked on average fewer hours than younger people in all countries, and European countries had an on average older population, this could partly account for the lower hours in Europe. We investigate differences in the composition by gender, age, education, and sectors. Any of these factors can play a role in accounting for hours differences across countries only if both the composition across countries is different *and* different groups exhibit different labor supply behavior within a country. Since the age and gender compositions across countries are in fact very similar, these two factors turn out not to play a role. By contrast, the educational compositions differ vastly across countries. In general, Europe has a higher share of low- or medium-educated individuals and a lower share of high-educated individuals than the US, especially in Eastern and Southern Europe. While weekly hours worked are similar for the three educational groups, employment rates increase substantially by education in all countries. Therefore, we find that differences in the educational composition between the US and the European countries are very important for understanding the hours differences via their impact on employment rather than on weekly hours worked. Differences in the sectoral structure turn out to matter only minimally in the statistical decomposition because differences in weekly hours per worker between sectors are small, though larger than between education groups. Since we cannot assign non-working individuals to a sector, our analysis does not capture the connection between sectoral shifts and employment rates, see [Rogerson \(2008\)](#).

Figure 1 summarizes our results: weeks worked account for between one third and one half of the Europe-US hours differences, and the educational composition for another one third to one half. However, because of the strong negative cross-country correlation between employment rates and weekly hours worked, this does not imply that these two components alone account for almost all of the differences. Lower weekly hours worked per person account for 75 and roughly 40 percent of the lower hours in Scandinavia and Western Europe, respectively, than in the US, with employment rates in Scandinavia predicting significantly higher hours there than in the US. By contrast, for Eastern Europe and Southern Europe (excluding Portugal), lower employment rates account for roughly one half and one quarter, respectively, of the lower hours than in the US, with weekly hours worked in Eastern Europe predicting higher hours there than in the US. Lower hours in Portugal are driven exclusively by the lower number of weeks worked and the educational composition.

What do our results imply for the study of hours worked differences between Europe and the

Figure 1: Decomposing the Europe-US Hours Gap



US? We arrive at three main conclusions. First, differences in vacation days play a quantitatively significant role in accounting for hours worked per person differences across countries. Should we think of the number of vacation days as individual choice variables, or are they rather pre-determined from an individual perspective? We document an essentially zero correlation between weeks worked per year and either employment rates or weekly hours worked per employed, which could be indicating the latter. In that case, the question arises which institutional factors drive international differences in vacation weeks. Moreover, to analyze the driving forces (e.g. taxation) of the hours worked decision from an individual perspective, one might want to use a model that takes vacation days as exogenous, similarly to e.g. the model used in [Kaplan \(2012\)](#). In this model, involuntary unemployment (in our case vacation weeks) determines the number of weeks worked per year, and agents only choose hours worked per work week optimally. Assuming separability in the utility function between weeks worked and hours worked per week could lead to a zero correlation between weeks worked per year and either employment rates or weekly hours worked per employed. On the other hand, models with positive externalities of sharing leisure time together or with a (negative) signalling effect of taking annual leave could lead to multiple equilibria with either high or low vacation days as equilibrium outcomes, and factors like taxes could serve as coordination devices on an equilibrium.

Second, lower hours worked in Scandinavia and Western Europe are driven by lower weekly hours per employed, and in Eastern and Southern Europe by lower employment rates. These facts are robust to controlling for differences in the demographic and sectoral composition across countries. What can explain these differences? Generating the negative correlation between em-

ployment rates and weekly hours worked in a quantitative macro model is not trivial, since most factors driving the individual labor supply decision tend to influence both components in the same direction. Analyzing the sources of the negative correlation is thus a fascinating new research agenda. In [Bick and Fuchs-Schündeln \(2016\)](#), we present some suggestive evidence that international differences in part-time regulation could drive the correlation.

Third, the educational composition plays a significant role in accounting for employment rate differences across countries. This calls for models that endogenize human capital accumulation decisions in order to understand why college graduation rates are much higher in some countries than in others. What are the policies that drive different educational compositions across countries? For example, [Guvenen et al. \(2014\)](#), while not distinguishing between employment and hours per employed, show that progressive taxation distorts the incentives to invest in human capital, and that these tax differences can explain a sizable part of the differences in the Europe-US hours per person gap for men. A further interesting new question that arises is why employment rates uniformly increase by education, whereas hours per employed do not vary much by education.

The remainder of the paper is structured as follows: Section 2 describes the micro data sets and explains how we measure hours worked per person, employment rates, and hours worked per employed. Section 3 compares aggregate hours worked from LFS data to those reported by NIPA. Section 4 reports the Europe-US hours difference for LFS and NIPA data, and analyzes implications of using LFS data instead of NIPA data for measuring productivity differences, as well as for models that postulate taxation as the major driving force of international hours differences. Section 5 then comes to the core analysis and decomposes aggregate hours worked differences between Europe and the US in its different components, and analyzes the role of different demographic subgroups. Finally, Section 6 concludes.

2 Data and Measurement

In this section, we first introduce the three labor force surveys, followed by the key questions from these surveys that we rely on to measure hours worked per person. Section 2.3 then presents the two main challenges that we face in measuring hours worked consistently across countries, namely the sampling of reference weeks and the underreporting of vacation days. Only the former affects the measurement of the employment rate (by definition), but we show that this is not a major problem. In contrast, we document that both of these challenges play a potentially large role for the measurement of hours worked per employed. Section 2.4 explains how we construct hours worked per employed to overcome these two issues.

At the start of this section, let us define the main variables used throughout the paper. H refers to average annual hours worked per person, and H^E are average annual hours worked per employed. e is the employment rate, h are hours worked per employed in a non-vacation week (a term which we use interchangeably with weekly hours worked), and w is the average number of non-vacation weeks in a year (which we use interchangeably with weeks worked), such that

$$H^E = h \times w,$$

and

$$H = e \times H^E = e \times h \times w.$$

We call the employment rate e and hours worked per employed H^E the two margins of labor supply, as usual in the literature, while we talk about components when we further divide hours worked per employed into weekly hours in a non-vacation week and weeks worked.

2.1 Data Sets

We construct hours worked from three different micro data sets, namely the European Labor Force Survey, the Current Population Survey, and the German Microcensus.

European Labor Force Survey The European Labor Force Survey (ELFS) is a collection of annual labor force surveys from different European countries. We use the yearly surveys, since the quarterly ones do not provide information on education. The ELFS covers Belgium, Denmark, France, Greece, Italy, Ireland, the Netherlands, and the UK from 1983 on, Portugal and Spain starting in 1986, Austria, Norway, and Sweden starting in 1995, Hungary and Switzerland starting in 1996, the Czech Republic and Poland starting in 1997, and Germany starting in 2002.² The sample size of the ELFS varies across countries and also within a country over time, but is always of considerable magnitude. The minimum annual sample size in the original data we use is 15,400 for Denmark, a country with roughly 5.5 million inhabitants.

Current Population Survey For the US, we use the Current Population Survey (CPS), which is a monthly survey of around 60,000 households. Specifically, we work with the CPS Merged Outgoing Rotation Groups data provided by the National Bureau of Economic Research (see <http://www.bls.gov>):

²For the Netherlands, we have information from 1983, 1985, and annually from 1987 on. The ELFS also covers Finland from 1995 on. However, the Finnish data have large numbers of missing observations for several years, which implies that we could only use data from 1997 to 2002 for our analysis. The ELFS covers more transition countries, which we also exclude from the analysis because of a shorter time series and a lack of information on vacation days.

[//www.nber.org/data/morg.html](http://www.nber.org/data/morg.html)). This data set includes only those interviews in which the households are asked about actual and usual hours worked, namely the fourth and eighth interview of each household. The data cover around 300,000 individuals per year.³

German Microcensus Until Germany enters the European Labor Force Survey in 2002, we use data from the German Microcensus. The German Microcensus covers a one percent random sample of the population of Germany and is an administrative survey. We use the scientific use files, which are a 70 percent random subsample of the original sample. This leaves us with a sample size of between 400,000 and 500,000 individuals per year. The scientific use files are available biannually from 1985 on, and annually from 1995 on. East Germans are included in the sample from 1991 onwards.

2.2 Key Survey Questions and Sample Selection

To measure employment rates and hours worked per employed person, we rely on five survey questions. We construct the employment rate based on the self-reported employment status in the reference week, which is usually the week prior to the interview. Employed individuals include, in addition to employees, the self-employed and unpaid family workers. Moreover, being employed does not require that the individual works positive hours in the reference week. To estimate hours worked for employed individuals, we rely on questions about actual hours worked in the main job in the reference week, actual hours worked in additional jobs in the reference week, usual hours worked in the main job in a working week, and reasons for having worked more or less hours than usual in the reference week. Web Appendix Section W.1.1 discusses how we deal with missing values for these questions, and explains why we have to drop three country-year pairs (1983 for Denmark, 2001 for the UK, and 2005 for Spain). We include in the final sample all observations of individuals aged 15 to 64. Web Appendix Section W.1.1 also provides an overview of the annual final sample size per country, which ranges from 10,000 to 450,000 observations, with an average of 111,000 observations.

2.3 Two Challenges

We face two key challenges when measuring hours worked per person across countries: first, the sampling of reference weeks differs across countries and within European countries over time,

³While it is well known that wages are imputed for many individuals in the CPS, this is not the case for hours, of which less than 1% are imputed.

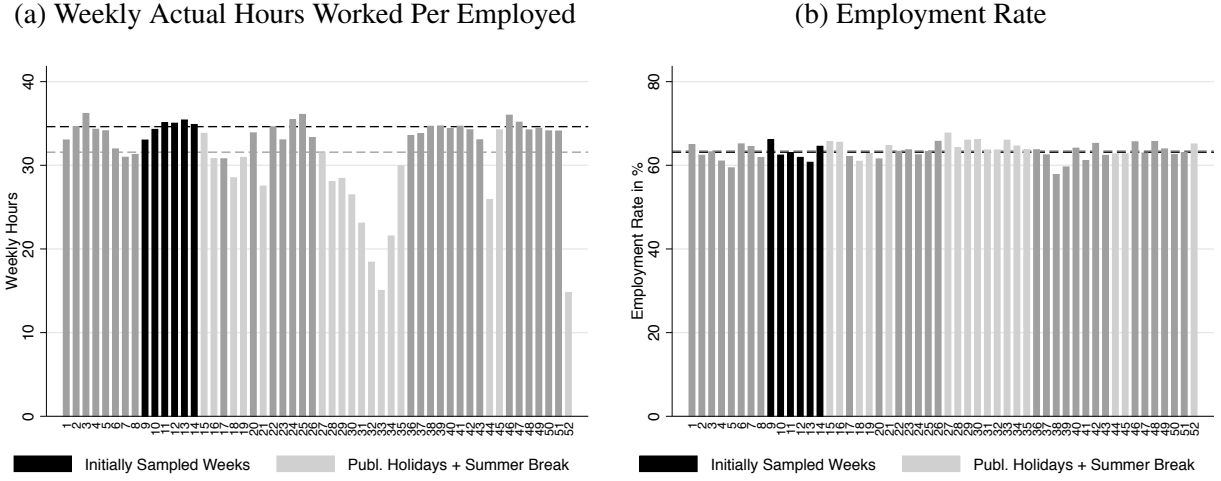
potentially inhibiting the comparability of measured hours. Secondly, we find that vacation days are systematically underreported in labor force surveys.

2.3.1 Sampling of Reference Weeks

The main difference between the several surveys, at a given point in time across all countries or for a given country over time, regards the sampling of reference weeks over the year. The CPS samples all 12 months of the year, but uses as a reference week always the week including the 12th day of a month. Therefore, most major US public holidays are not captured by the CPS (e.g. Memorial Day, 4th of July, Thanksgiving). The reference weeks in the national labor force surveys of the European countries initially fell only into country-specific periods ranging from one single reference week to the sampling of half a year. From 2005 onwards, each week of a year is sampled in the European Labor Force Survey. Eurostat, in its efforts to harmonize the different surveys as much as possible, treated the changes in reference weeks in a two-step procedure. First, if the change to sampling all weeks occurred in a country before 2005, the ELFS micro data reflect this by changing from sampling only single weeks to sampling the second quarter of the calendar year (April to June) from then on until 2004. Exceptions to this rule are detailed in Web Appendix [W.1.2](#). In a second step from 2005 onwards, when the majority of countries included in the ELFS had switched to continuous surveying, Eurostat makes all 52 weeks of the year available. The only exceptions to this second step rule are the UK (continuous surveying from 2008 on), Ireland (from 2009 on), and Switzerland (from 2010 on).

The differences in the sampling of reference weeks raise the question in how far estimates of the employment rate and hours worked per employed are comparable across countries in a given year, and within a country over time. Since there was no change for the US, the latter question is only relevant for the European countries. To give a concrete example, Figure 2 shows weekly average actual hours worked per employed in the left panel, and weekly employment rates in the right panel, for France in 2006 by reference week. The black weeks are the weeks that were initially sampled in France until 2002 (weeks 9 to 14). The light gray weeks are weeks that include a public holiday, plus the summer vacation weeks. As one can see in the left panel of Figure 2, weekly hours worked vary substantially over the 52 weeks of the year, and are on average significantly lower in vacation weeks. The sampling of reference weeks thus matters for the aggregate: the grey horizontal bar indicates average weekly hours worked over all 52 weeks, while the black horizontal bar indicates average weekly hours worked over the initially sampled black weeks: the difference amounts to 3.1 weekly hours. By contrast, the right panel of Figure 2 shows that the employment rate is roughly constant over all 52 weeks of the year.

Figure 2: Avg. Weekly Actual Hours Worked Per Employed and Employment Rate (France, 2006)



To analyze the extent of seasonality in measures of the employment rate and hours worked per employed more generally, we exploit (as in the example above for France) the fact that the ELFS from 2005 onwards samples all weeks of the year for most countries, and also states the reference week for each interviewed person. Thus, for these years, we analyze how employment rates and hours worked per employed differ if they are constructed using information from only the initially sampled weeks, i.e. only those weeks which served as country-specific reference weeks prior to the change to continuous surveying (e.g. the black weeks in Figure 2 for France), and using all weeks of the year as reference weeks. We use all available country-year pairs from 2005 to 2011, which are in total 113 observations (for 15 of our 18 European countries we can do the comparison in all years starting 2005, for the UK, Ireland, and Switzerland only starting later).⁴

Hours Worked per Employed We calculate a measure of “raw” annual hours worked per employed as the sum of actual weekly hours worked of all employed individuals multiplied by 52 weeks in a year:

$$H^{E,raw} = 52 \times \frac{1}{N^e} \sum_{i=1}^N \varepsilon_i \eta_i^{raw},$$

where ε_i is the self-reported employment status of individual i , which takes the value 1 for anyone reporting to be employed (including self-employment or being an unpaid family employee), and 0 otherwise; η_i^{raw} are the actual hours worked in the reference week in all jobs of individual i ; N is the

⁴In Web Appendix W.1.2, we show corresponding evidence when the second quarter is used as reference period, as done for the interim period in the European countries. Differences to using all weeks of the year as reference period are somewhat smaller than under the initially sampled weeks, but still substantial.

total number of individuals; and N^e is the number of employed individuals, i.e. $N^e = \sum_{i=1}^N \epsilon_i$. All measures are calculated using the individual survey weights, which we omit for ease of exposition.

Table 1 shows in the first row the absolute percentage deviation of annual hours worked per employed (aged 15 to 64) when using only the initially sampled reference weeks from using all weeks of a year, which amounts on average to 3.5%. At the 90th percentile, the deviation already reaches 7.0%, with a maximum deviation of 12.6% in Sweden for the year 2008. Thus, the sampling of the reference weeks matters substantially for the measurement of hours worked per employed. With only few exceptions, the hours when only specific survey weeks are sampled are larger than when all weeks of the year are sampled.⁵

Employment Rate The employment rate (e) is simply given by the number of employed individuals divided by all individuals in the sample

$$e = \frac{N^e}{N}. \quad (1)$$

Equation (1) is the employment to population ratio for the population 15-64, but we henceforth refer to it as the employment rate.⁶ The second row of Table 1 shows that the employment rate exhibits significantly less seasonality than the raw hours worked per employed measure. The average absolute percentage point deviation between constructing the employment rate only based on specific survey weeks relative to the entire year amounts to only 0.7 percentage points. At the 90th percentiles, the difference is still relatively small with 1.3 percentage points. Moreover, employment rates are not systematically higher (or lower) if only specific weeks are sampled than when the entire year is sampled. There are only a few observations that are worrisome with deviations over 5 percentage points. The five country-year observations above the 95th percentile come from Germany (four times) and Belgium. Both countries used only one specific week as reference week (Germany until 2004, Belgium until 1998), suggesting that the corresponding time-series of the employment rates have to be used with some caution.

⁵This is the case for all countries in all but at most one year. The only exception are the Netherlands, where hours are lower in the initially sampled weeks, with the exception of two years.

⁶Web Appendix Section W.1.3 reports two alternative measures of the employment rate. The first alternative measure relies on defining employment based on usually working positive hours. This leaves the employment rate virtually unchanged. The second alternative measure involves a different definition of employment for women on maternity leave. This has only a modest impact on female employment rates, and is far too small to drive international differences in female employment rates. Note that by construction, hours worked per person remain always the same no matter what definition is used for the employment rate, because an increase (decrease) in the alternative employment rate relative to our baseline definition is always offset by a decrease (increase) in the corresponding measure of hours worked per employed.

Table 1: Absolute %-Deviations* of $H^{E,raw}$, e , and H^E Using Only Initially Sampled Weeks from Using All 52 Reference Weeks

	Mean	75th	90th	95th	99th	Max
$H^{E,raw}$	3.5	4.7	7.0	7.9	11.4	12.6
e	0.7	0.8	1.3	1.9	5.3	5.9
H^E	0.8	1.1	1.5	2.1	3.7	5.0

Note: For $H^{E,raw}$ and H^E we report deviations in percentages, whereas for e we use percentage points.

2.3.2 Underreporting of Vacation Weeks

For most European countries, all weeks of the year are sampled from 2005 onwards. If each week would be sampled with equal probability and cover a representative sample of the population week by week (rather than only over the entire year), then average vacation weeks should be captured accurately in the labor force surveys. Calculating the average number of vacation weeks from the micro data yields an average of 3.3 “self-reported” vacation weeks, where we define vacation as the sum of public holidays and annual leave.⁷ Given that public holidays alone in all countries sum up to 1.5 to 2.5 weeks, these self-reported weeks of annual leave and public holidays seem implausibly low. In fact, based on external data sources, the average weeks of vacation over the same time period for our sample of European countries amount to 6.8 weeks per year.⁸

To get a better understanding of the sources of this discrepancy, we investigate in more detail the case of Germany, which features the largest difference among all countries, amounting to 5.5 weeks. While we provide all details in Web Appendix Section W.2.2, our results of this analysis can be summarized as follows. First, using the German Socio-Economic Panel, Schnitzlein (2011) reports that on average 3 of the average 31 entitled days of annual leave per year go unused. Thus, the underusage of entitled leave can explain only a very small portion of the discrepancy of 5.5 weeks between self-reports and official vacation days. Second, not all weeks are sampled with the same probability in the Microcensus, see Figure W.1 in Web Appendix Section W.2.2. For example, the reference week which contains Christmas day is on average sampled with a probability of 1.3%, significantly below the 1.9% that would be implied by equal sampling. Third, the German Statistical Office also has some evidence that respondents might dislike using a vacation week as a

⁷Table W.10 in Web Appendix W.2.2 reports the results for each country as well as the description of how we construct the self-reported vacation weeks.

⁸Web Appendix W.2.1 lists the external data sources and explains further assumptions in the construction of the number of vacation weeks. It also shows that the time series variation in vacation weeks within each country is small, with the notable exception of Denmark. For the US, the discrepancy between self-reported and external vacation weeks is somewhat smaller but still substantial, with 1.4 vs. 3.5 weeks. We expect a discrepancy for the US, since weeks with major public holidays are not sampled.

reference week, either because they are too busy the first week after a vacation to fill out the questionnaire, or because they perceive it as “inappropriate” to use a vacation week as reference week when in fact they are generally hard working. Summarizing, at least for Germany there exists evidence of underreporting of days of annual leave and public holidays in the Microcensus even after the introduction of continuous sampling over the entire year. It seems at least not implausible that these factors can explain the discrepancies between the self-reported and external vacation weeks for the remaining countries as well. Therefore, it is important to adjust hours worked per employed for vacation using external data in the European countries even when analyzing the recent cross-section from 2005 onwards.

2.4 Measurement of Hours Worked per Employed

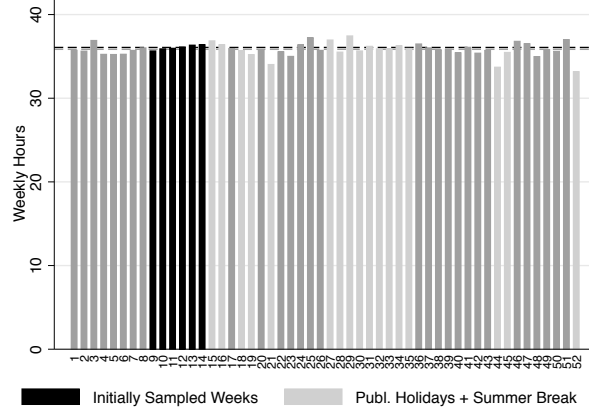
As documented so far, the raw measure of hours worked per employed suffers from two weaknesses: first, seasonality in hours worked per employed impedes the comparability of hours worked across countries and within European countries over time because of differences in the sampled reference weeks; secondly, vacation weeks are underreported in the labor force surveys even if all weeks of a year are sampled. We therefore apply the following adjustment to construct a measure of hours worked per employed that overcomes both weaknesses: we first obtain individual hours worked in a *non-vacation* week, i.e. a typical work week without a reduction in work time because of a public holiday or annual leave, and then require *consistency* of annual leave and public holidays in the micro data with the country-wide average. This closely follows the procedure in [Pilat \(2003\)](#).

To calculate hours worked in a *non-vacation* week η_i for each employed individual, we use as a baseline actual hours worked in all jobs in the reference week. However, if a respondent indicates that he/she worked less hours than usual in the main job in the reference week, and states as the main reason for doing so public holidays or annual leave, we replace weekly hours by usual hours in the main job plus actual hours worked in all additional jobs.⁹ Thus,

$$\eta_i = \begin{cases} \begin{array}{ll} \text{usual hours in main job} & \text{if actual hours in main job} < \text{usual hours in main job} \\ + \text{actual hours in all additional jobs} & \text{because of annual leave or public holiday} \end{array} \\ \text{actual hours in all jobs } \eta_i^{raw} & \text{otherwise.} \end{cases}$$

⁹Note that respondents can only indicate one reason for working different hours than usual, and for additional jobs we do not have information on usual hours. In Web Appendix [W.1.4](#) we discuss some differences between the CPS and ELFS questionnaire regarding the construction of our hours measure, which however have virtually no impact on the statistics presented in the paper.

Figure 3: Average Hours Worked in a Non-Vacation Week h (France, 2006)



We refer to these hours η_i as “hours worked in a non-vacation week”. Averaging over our population of interest yields mean weekly hours worked in a non-vacation week h , i.e.

$$h = \frac{1}{N^e} \sum_{i=1}^N \varepsilon_i \eta_i. \quad (2)$$

If people work less hours than usual for other reasons than vacations, e.g. because of sickness, or more hours than usual because of overtime, this is captured by this measure. Figure 3 shows this measure of hours worked in a non-vacation week for France in 2006. It does not show any seasonality anymore, in contrast to the raw measure of average weekly hours worked in the left panel of Figure 2.

In order to establish consistency of annual leave and public holidays in the micro data with the country-wide average from external data sources, we multiply our mean weekly hours worked in a non-vacation week h with the number of non-vacation weeks w . We obtain our estimate of w by subtracting the country-wide average weeks of annual leave and public holidays reported in external data sources from the 52 weeks of a year, i.e.

$$w = 52 - \frac{\text{country-wide average days of annual leave \& public holidays}}{5}. \quad (3)$$

The disadvantage of this procedure is that we cannot account for heterogeneity across the population in terms of days of annual leave and public holidays. In Web Appendix Section W.2.5 we allow for heterogeneous vacation weeks. Specifically, we assume that the heterogeneity in self-reported vacation weeks reflects the true degree of heterogeneity, but we still impose that the average num-

ber of vacation weeks corresponds to the one from external sources. The implied differences to the case of homogeneous vacation weeks are small.

The third row of Table 1 shows the deviation of the annual hours worked per employed measure ($H^E = h \times w$) if only the initially sampled survey weeks are used as reference weeks, compared to all weeks of the year. While for the “raw” measure of hours worked per employed in the first row the mean absolute percentage deviation amounts to 3.5%, the mean absolute percentage deviation of our measure of hours worked per employed is with 0.8% substantially smaller. Thus, externally adjusting for vacation is successful in insuring comparability of the data over time. Only at the top end of the distribution we still see a non-negligible effect of the sampling of the reference weeks. The three countries with deviations in the top five percent are Belgium, Norway, and Poland.

Finally, while we document the need to adjust for hours lost due to public holidays and annual leave, the same could in principal apply to working less hours than usual because of sick leave or other reasons, and also to working more hours than usual (overtime and additional jobs). There are two dimensions to this issue. First, in how far do such differences between usual and actual hours vary with the set of reference weeks available? In Web Appendix Section W.3, we provide evidence that none of the other reasons for working more or less time than usual vary with the set of reference weeks, thus seasonality is not important for them. Second, is there systematic under- or overreporting of these categories? We collect some suggestive evidence for sick days for a subset of countries and years. Comparing sick days from external data sources to the reported sick days in our data, we find that the self-reported number of sick days are smaller than sick days from external data sources, a similar finding as the one for vacation days. However, the discrepancy is on average smaller than for vacation days and public holidays, with on average 1.2 weeks in Europe and 0.3 weeks in the US, see Web Appendix Section W.3.

3 Comparing LFS Hours with NIPA Hours

We use data from labor force surveys to analyze the role of different margins and the demographic composition for international hours worked differences. This raises the natural question how the aggregate hours constructed from labor force surveys (henceforth referred to as LFS hours) compare with hours in the National Income and Product Accounts (NIPA). In this section, we show that differences between aggregate hours in LFS and NIPA are large, and argue that they are not driven by conceptual differences between both, but rather by the use of vastly different kinds of data sources and methods in the construction of NIPA data.

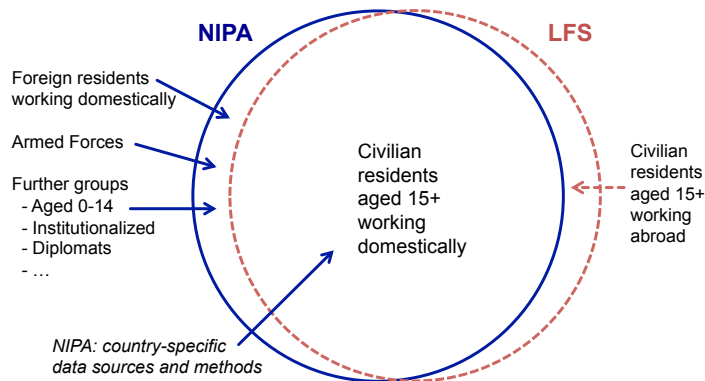
We rely on two commonly used sources for international NIPA data. The OECD gathers in

its “National Accounts Database” (stats.oecd.org) total hours worked and total employment at an annual frequency provided by the national statistical agencies. The measurement of both variables follows the most recent System of National Accounts (SNA) guidelines, see Chapter 19 in [European Commission et al. \(2009\)](#) and Chapter 11 in [Eurostat \(2013\)](#). Secondly, the Conference Board provides total hours worked and total employment in its “Total Economy Database” (TED) (<http://www.conference-board.org/data/economydatabase>). Both OECD and TED data have been widely used in the literature studying driving forces and implications of aggregate hours differences across countries. Since for the majority of countries and years in our sample the data from the OECD and the TED are exactly the same, we focus on the comparison of LFS data to NIPA data obtained from the OECD’s “National Accounts Database”. Note that the five main papers explaining hours worked differences between Europe and the US with quantitative macro models ([Prescott \(2004\)](#), [Rogerson \(2006\)](#), [Ohanian et al. \(2008\)](#), [McDaniel \(2011\)](#), and [Ragan \(2013\)](#)) all use slightly different approaches to calculate hours worked per person.¹⁰ With the exception of [McDaniel \(2011\)](#), these papers multiply a measure of total hours worked per employed, either from the OECD or from the TED, with variants of the civilian employment rate based on OECD data (see Web Appendix Section W.4.4 and [Bick et al. \(2016\)](#) for details). We opt to work with NIPA data, since employment then refers to total employment in both hours worked per employed and the employment rate, thus canceling out when calculating hours worked per person.

The main conceptual difference between LFS and NIPA estimates of employment and hours worked relates to the covered population. LFS data cover civilian, non-institutionalized residents of a country aged 15 and older. NIPA data deviate from this in two dimensions. Figure 4 illustrates these differences in the coverage. First, employment and hours estimates in NIPA are based on the domestic concept and constructed such that the labor inputs are consistent with the measurement of gross domestic output (GDP), while LFS follow the national concept based on residence of the worker. Thus, NIPA exclude employment and hours worked of civilian, non-institutionalized residents who work in a foreign country (e.g., from the German perspective a resident of Germany working in Switzerland). On the other hand, NIPA data include domestic employment and hours worked even if they originate from individuals residing in a foreign country (e.g., from the German perspective also hours worked by residents of Switzerland working in Germany). In addition, NIPA data do not restrict the covered population to the non-institutionalized civilians aged 15 and

¹⁰The OECD also provides information on average annual hours actually worked per worker in its “Labour Database” under the category “Labour Force Statistics”. For most countries in our sample and for most years, this estimate is equal to total hours worked divided by total employment from the “National Account Database”. Moreover, the OECD provides under the category “Labour Force Statistics” two different measures of civilian employment, one under the “Annual Labor Force Statistics”, another one under “LFS by sex and age”, which generally do not coincide, although the differences are usually small.

Figure 4: Population Coverage in NIPA and LFS

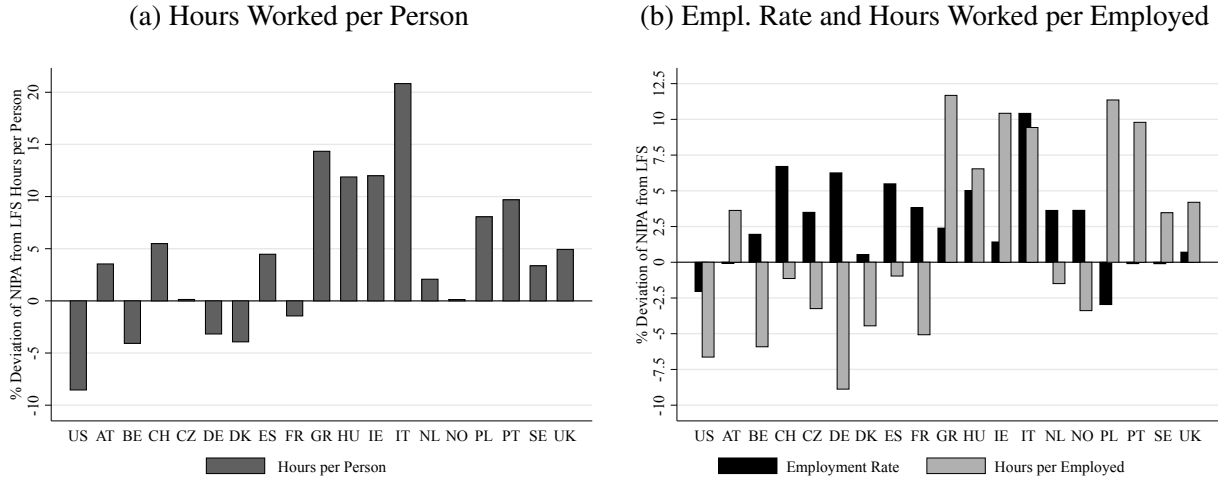


older, but include employment and hours worked from all individuals contributing to GDP: non-civilians (members of the armed forces) and further groups, including individuals younger than 15, institutionalized individuals (e.g., prisoners), and others as e.g., diplomats (e.g., from the German perspective the German ambassador in the US) or students abroad. Secondly, besides these differences related to the covered population, LFS and NIPA data on hours worked and employment can differ for the same covered population (i.e. civilian, non-institutionalized residents of a country aged 15 and older that do not work in a foreign country; the intersection in Figure 4). The national statistical agencies use very different country-specific kinds of data sources and methods in the construction of NIPA data (see Web Appendix W.4.1), which makes the cross-country comparison of hours worked difficult, despite the efforts to harmonize measurement through the Systems of National Accounts, see also Fleck (2009). These data sources comprise administrative data, social security data, employer surveys, labor force surveys, census data, etc. In fact, the OECD remarks on its website that “The [hours worked] data are intended for comparisons of trends over time; they are unsuitable for comparisons of the level of average annual hours of work for a given year, because of differences in their sources” and recommends using employment rates based on labor force surveys for cross-country comparisons: “National Labor Force Surveys are the best way to capture unemployment and employment according to the ILO guidelines that define the criteria for a person to be considered as unemployed or employed... data from LFS make international comparisons easier compared to a mixture of survey and registration data ...”.¹¹

Having discussed the conceptual differences between LFS and NIPA hours, we now turn to quantifying the observed differences. As commonly done in cross-country comparisons, we focus

¹¹Both quotes are from the OECD’s website: <http://stats.oecd.org/Index.aspx?DataSetCode=ANHRS> and <http://www.oecd.org/els/emp/basicstatisticalconceptsemploymentunemploymentandactivityinlabourforcesurveys.htm>. They were retrieved on August 12, 2016.

Figure 5: Percentage Deviations of Hours Worked and Employment in NIPA from LFS



on the comparison of hours per person rather than total hours worked. We obtain a NIPA measure of hours worked per person by dividing NIPA total hours by the population aged 15 to 64 obtained from the OECD’s “Annual Labour Force Statistics”.¹² For the LFS data, we divide LFS hours by the population aged 15 to 64 directly taken from the LFS, i.e. by the civilian, non-institutionalized population aged 15 to 64.

Figure 5a shows the average country-specific percentage deviation of NIPA estimates for hours worked per person from LFS estimates for the recent pre-crisis years 2005 to 2007. The NIPA estimate is larger than the LFS estimate for the majority of countries (on average by 7.2%). Only in 5 out of 19 countries are the NIPA estimates below the LFS estimates (on average by -4.2%).

To gain a better understanding of the sources of these differences, we turn to the two margins of labor supply. Figure 5b shows for the employment rate (black bars) and hours worked per employed (grey bars) the percentage deviations of the NIPA estimate from the respective LFS estimate. The NIPA employment rate estimate exceeds the LFS estimate in the majority of countries (on average by 4.0%, or 2.2 percentage points). Italy stands out with the difference exceeding 10%, followed by Switzerland, Germany, and Spain with differences of over 5%. In 5 countries is the NIPA employment rate lower than the LFS one, however only in the US and Poland in an economically significant way. Relative to the employment rate differences, the hours per employed differences are less systematic. In fact, the NIPA hours per employed estimate is lower than the

¹²These data can be found in the OECD’s “Labour Database” under the category “Labour Force Statistics”, and cover all residents of a country. The OECD National Accounts data do not provide any population figures broken down by age groups. Population figures are generally only available for the national concept and including everyone independent of status (civilian vs. non-civilian, institutionalized vs. non-institutionalized).

LFS estimate for 10 countries (on average by -4.1%) and higher in 9 countries (on average by 7.8%). There is also no systematic relationship between NIPA-LFS differences for the employment rate and hours per employed. The correlation between the two differences is -0.13.

What drives these differences between NIPA and LFS estimates? We can partially analyze this for employment rates, based on additional data from the OECD’s “National Accounts Database” and “Annual Labor Force Statistics”. In Web Appendix [W.4.2](#), we provide a detailed discussion of this investigation. In a nutshell, differences in employment stemming from the location of employment, i.e. the net difference in domestic residents working abroad and foreign residents working domestically, are for most countries negligible, with the exceptions of Switzerland and Hungary. The exclusion of non-civilian employment, i.e. the armed forces, in the LFS is also essentially irrelevant for the differences (even in the US). The “further groups” in Figure 4 are generally too small to rationalize the remaining employment rate differences. This leaves as the major driving force of the differences the use of different kinds of data sets and different methods by the national statistical agencies.

Unfortunately, for hours worked per employed we cannot conduct such a comparison, since the OECD does not provide hours for the armed forces or the total population using the national concept as for employment. The documentations provided by the national statistical agencies on how hours are estimated are also not helpful in getting quick insights into the differences. Web Appendix [W.4.1](#) shows in the left column the country-specific main data sources to construct employment rates, and in the right column the main sources to construct hours worked per employed. Both differ widely across countries. For Germany, for example, in addition to the two main data sources mentioned in the table, the hours estimate relies on 60 different data sets and is estimated with various econometric models. This makes it impossible to investigate what exactly generates the differences relative to the German LFS data.

For the US in turn, it is well known and documented that the hours estimates based on the CPS differ from NIPA estimates, for which the Current Employment Statistics (CES) by the BLS are the main data source. Through 2005, the CES data cover only production workers in goods-producing industries, and non-supervisory workers in services-providing industries, both within the private non-agricultural sector. These groups tend to have lower hours than the non-covered groups. For non-production and supervisory workers, hours are imputed based on data from 1978 assuming the same trends as for the covered groups, though data based on the CPS are not supporting the common trend assumption, see [Eldridge et al. \(2004\)](#). Only from 2006 onwards, all employees are covered. For all years, the NIPA estimate is supplemented by hours of self-employed and unpaid family workers from the CPS. Our data from the CPS in turn always cover all employees, next to

the self-employed and unpaid family workers. Another difference is that the CES measure hours per job, while the CPS measures hours per person in all jobs. In the presence of multiple job holders (about 5 to 6% of the population), the CES estimate will therefore be downward biased. Next, the CES measure hours paid, which are adjusted for paid vacations but not off-the-clock work, whereas the CPS measures hours worked. Last, there are differences in the reference period. The CES report hours for the pay period that includes the 12th of a month and can be weekly, biweekly or monthly, whereas the CPS reports hours for the week which includes the 12th of a month. [Frazis and Stewart \(2010\)](#) conclude that these differences can largely account for the level differences between CPS and NIPA hours estimates. They further document that hours in the CPS line up well with those from the American Time Use Survey, disproving an often mentioned criticism that hours in labor force surveys are overreported. [Ramey \(2012\)](#) shows that the data source matters for the measurement of the trend and cyclical behavior of labor productivity, and suggests the use of the CPS hours series.

While we have documented that in terms of levels NIPA and LFS hours estimates differ substantially for most countries, the time trends are much more in line with each other, although there are some exceptions. Figures [W.22](#) to [W.40](#) in Web Appendix [W.4.3](#) show for each country the time-series of hours per person, employment rates and hours per employed based on LFS and NIPA data from the OECD, and in addition from TED. As mentioned before, for most years and countries, the OECD and TED data series coincide, while the TED data usually go further back in time than the OECD data (and the LFS data).

Which data source is better suited for international comparisons remains an open question. We do not want to discount by any means the important and careful work by the national statistical agencies to measure labor inputs and output in each country in a consistent way. We want to emphasize however that the advantage of the labor force surveys is that we use a consistent data source and apply exactly the same methodology across countries, while NIPA estimates differ substantially in country-specific ways in both the kind of data sources used and the methodology applied. On top of this, NIPA data both by the OECD and the TED are subject to substantial revisions over time that also apply to previous years, which affect quantitative statements dramatically, see Web Appendix [W.4.4](#) and [Bick et al. \(2016\)](#). As argued in [Johnson et al. \(2013\)](#) and [Pinkovskiy and Sala-i-Martin \(2016\)](#) for data revisions in the Penn World Tables, it is not clear that these revisions lead to improvements of the data, and the opposite might actually be true. As mentioned above, the OECD itself cautions that their data are not intended for cross-country comparisons of levels, and suggests the use of labor force surveys instead. Before exploiting the key advantage of our data, namely the possibility to analyze the importance of different components

Table 2: Avg. Hours Worked per Person Relative to the US (in %) - Summary Statistics 2005-2007

Country	LFS	NIPA
Mean	-19.0	-7.1
Standard Deviation	6.6	9.3
Min Abs Deviation	5.1	3.3
Max Abs Deviation	30.2	23.6

and the demographic composition for total hours worked per person, we discuss in the next section the quantitative differences in the estimates of the Europe-US hours gap in NIPA and LFS data.

4 Hours Differences between Europe and the US: Measurement and Implications

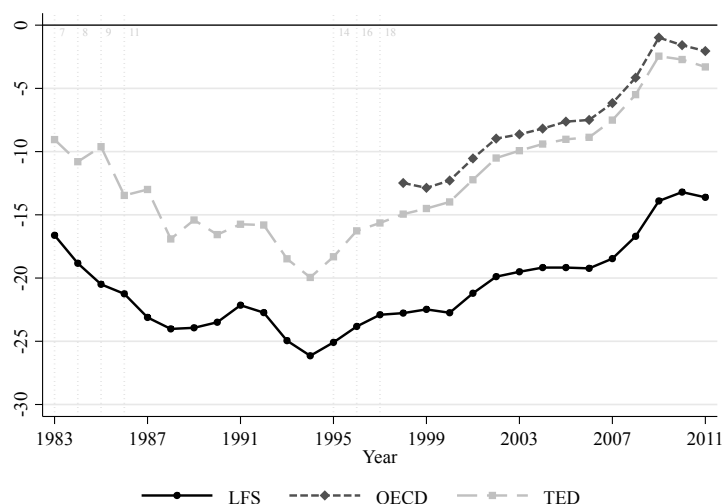
In this section, we first document hours worked per person differences between Europe and the US in the recent pre-crisis period 2005 to 2007 based on LFS data and NIPA data. We show that the differences are much larger based on LFS data. This is driven by both higher hours for the US and on average lower hours for Europe in LFS data. We then analyze two implications of the different measurements of the Europe-US hours gap, namely first for the measurement of productivity differences, and secondly for the analysis of models that postulate taxation as the major driving force of international hours differences.

4.1 Documenting Hours Differences between Europe and the US

Table 2 reports the difference in average hours worked per person between the 18 European sample countries and the US in LFS and NIPA data in the period 2005 to 2007. Based on LFS data Europeans work on average 19% fewer hours than US citizens, compared to only 7% based on NIPA data.¹³ Thus, the differences between Europe and the US are less than half as large in NIPA data than in LFS data, a stunning difference. The larger differences between European and US hours in LFS data relative to NIPA data are driven by both the higher hours worked per person estimates for the US in LFS data and the lower ones for Europe. US hours worked per person are with 1397 hours in LFS data 120 hours higher than in NIPA data with 1277 hours. By

¹³If we use the average vacation weeks from LFS data rather than from external data sources for our adjustment, the Europe-US hours gap is only mildly reduced to -16.1%. The population weighted Europe-US hours gap is -13.5% for LFS data and -6.7% for NIPA data.

Figure 6: Average Hours Worked per Person Relative to the US (in %), 1983-2011



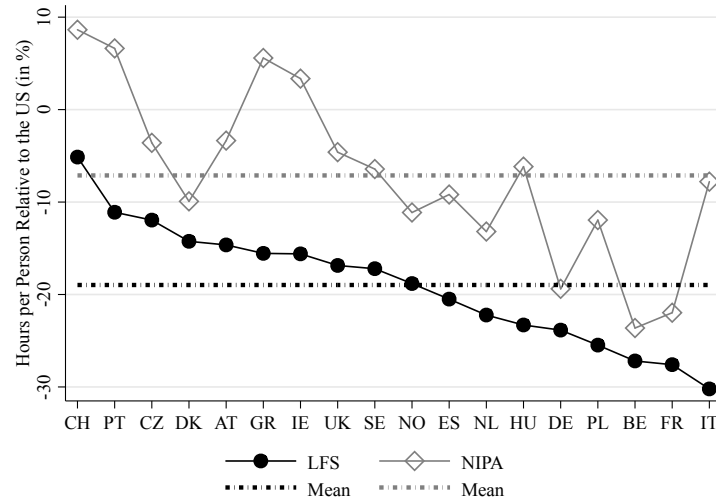
Note: The vertical lines indicate the years in which new countries enter the LFS sample, and the numbers next to them indicate the number of European countries in the sample from then on.

contrast, average hours worked per person over all European countries are with 1132 hours 55 hours lower in LFS data than in NIPA data. Therefore, around two thirds of the larger Europe-US hours difference in LFS data than in NIPA data come from higher US hours, and around one third from lower European hours. Finally, in terms of the cross-sectional variation within Europe, our data display a smaller standard deviation.

One might wonder whether the large discrepancies in the Europe-US hours difference between LFS data and NIPA data are an artifact of the pre-crisis cross-section, or have been present for some time. Figure 6 shows the average Europe-US hours difference in LFS data vs. OECD and TED data starting in the earliest sample year from the LFS data set, namely 1983.¹⁴ The vertical lines indicate the years in which new countries enter the LFS sample, and the numbers next to them indicate the number of European countries in the sample from then on. Since the number of European sample countries expands over time, the graph does not give a meaningful indication of the time-series development of the overall Europe-US hours difference before 1997. However, in any given year the sample countries are always the same in all three data sources. LFS data always indicate substantially larger Europe-US differences than either OECD or TED data, with the average absolute gap between the LFS and the OECD (TED) difference amounting to 11 (10) percentage points after 1997.

¹⁴The Europe-US hours gap is slightly larger for TED data as they feature a slightly larger hours per person estimate for the US, while TED and OECD hours per person estimates for Europe are basically the same.

Figure 7: Average Hours Worked per Person Relative to the US by Country, 2005-2007



Note that Prescott (2004), as well as other papers from this literature like Ohanian et al. (2008), Rogerson (2006), and McDaniel (2011), all rely on data from either OECD or TED using three different methods to measure hours worked per person, but find Europe-US hours gaps that are similar to the ones we document for LFS data. The reason is that both OECD and TED substantially revised their measures of hours worked per employed in new releases over the years, each time also affecting all previous years in the data series. Relying exactly on the formula and the data releases used by Ohanian et al. (2008), we find a Europe-US hours gap of 17.6% for 2003 (the latest available year in Ohanian et al. (2008)). Using exactly the same formula and same data sources, but working with the most recent releases from May 2016 (TED) and August 2016 (OECD), instead gives a gap of 11.0% for the year 2003.¹⁵ Web Appendix Section W.4.4 and Bick et al. (2016) give further evidence of the importance of data revisions in OECD and TED data.

Figure 7 plots hours worked per person differences (averaged over the years 2005 to 2007) between each European country and the US for the NIPA data (from the OECD) and LFS data, sorting the countries by decreasing difference to the US based on LFS data. With the exceptions of Switzerland, Portugal, Greece, and Ireland for NIPA data, hours worked per person in Europe are always lower than in the US. Furthermore, LFS data always predict a larger negative difference to the US than NIPA data. The smallest difference to US hours (in absolute value) in LFS data amounts to -5.1% for Switzerland, where NIPA reports higher hours than in the US by 8.6%. The largest difference to US hours in LFS data comes from Italy with -30%, where NIPA indicates

¹⁵Note that the three Eastern European countries in our sample are excluded from this comparison as they are not in the Ohanian et al. (2008) data set.

a difference of only -7.8%. Italy is the country on which the two data sources deviate most (22 percentage points), followed by Greece, Ireland, and Portugal. The smallest discrepancies arise for Belgium, Denmark, and Germany, with less than 5 percentage points. Still, the *ranking* of the countries is mostly preserved between both data sets: the correlation between the LFS hours worked per person measure and the NIPA measure is 0.74.

4.2 Productivity Differences between Europe and the US

Hours worked are a crucial input into the measurement of labor productivity, i.e. GDP divided by total hours worked. NIPA hours are generally the appropriate measure to calculate labor productivity because they are constructed specifically such that the labor inputs are consistent with the measurement of GDP. We (and the OECD itself) however argue above that LFS data might be better suited for international comparisons, since they are built using the same sources and methodology across countries. Given that LFS data provide different estimates of total hours than NIPA data, LFS data also lead to different conclusions regarding productivity differences between Europe and the US. Taking a measure of total GDP from the Penn World Tables (Y_{PWT}^{Total}), and defining total hours worked as H^{Total} , we can define labor productivity in country c as $LP_i^c = \frac{Y_{PWT}^{Total,c}}{H_i^{Total,c}}$ with $i = \{NIPA, LFS\}$. Labor productivity relative to the US is then defined as $\frac{LP_i^c}{LP_i^{US}} = \frac{Y_{PWT}^{Total,c}/Y_{PWT}^{Total,US}}{H_i^{Total,c}/H_i^{Total,US}}$. The larger the ratio between a country's hours and US hours in LFS data relative to NIPA data, the smaller is the labor productivity gap between this country and the US based on LFS data relative to NIPA data.

Table 3 calculates average GDP per hour worked over the years 2005 to 2007. In the first column, total hours worked are constructed from LFS data, in the second column they are taken from NIPA. GDP comes from the Penn World Tables Version 9.0, and is defined as the output-side real GDP at chained PPP in 2011 US-Dollar (*rgdpo*; see [Feenstra et al. \(2015\)](#)). GDP per hour worked in the US is normalized to 100 in both columns. The following rows then show GDP per hour worked in each of the European countries relative to the US. Total hours worked in the US are 10% higher in LFS data than in NIPA data, which leads to a lower estimate of GDP per hour worked in the US of \$49.7 (in 2011 US-Dollar) based on LFS data compared to \$57.9 based on NIPA data. We group the European countries into four regions, namely Scandinavia, Western Europe, Eastern Europe, and Southern Europe.

Given the larger hours difference between Europe and the US in LFS data than in NIPA data, we find smaller productivity differences overall between Europe and the US based on LFS data. While based on NIPA data Europe features 78% of the labor productivity of the US, based on

Table 3: GDP per Hour Worked Relative to the US (in %)

Country	LFS	NIPA
US	100.0	100.0
Europe	86.4	78.0
Denmark	88.3	86.9
Norway	172.0	161.8
Sweden	92.0	84.8
<i>Mean</i>	<i>117.4</i>	<i>111.2</i>
Austria	85.2	78.0
Belgium	91.4	88.7
France	98.3	92.5
Germany	97.0	94.2
Ireland	114.8	96.9
Netherlands	107.2	98.8
Switzerland	94.9	83.8
United Kingdom	92.0	80.3
<i>Mean</i>	<i>97.6</i>	<i>89.1</i>
Czech Republic	50.2	47.6
Hungary	45.2	37.8
Poland	40.1	34.4
<i>Mean</i>	<i>45.1</i>	<i>39.9</i>
Greece	64.0	51.3
Italy	93.7	74.0
Portugal	50.6	44.3
Spain	78.2	68.5
<i>Mean</i>	<i>71.6</i>	<i>59.5</i>

LFS data Europe's labor productivity amounts on average to 86% of the US one. Quantitatively, the differences across data sets are largest in absolute terms for Southern Europe: based on NIPA data, Southern Europe exhibits only 60% of the labor productivity of the US, while based on LFS data Southern Europe's labor productivity amounts to 72% of the US one. Put differently, the productivity gap is reduced by nearly one third relative to NIPA data. The results for Italy are particular striking, where the labor productivity gap nearly disappears for LFS data. Western European labor productivity is at 89% of the US productivity based on NIPA data, but comes very close to the US level with 98% based on LFS data. Hence, for Western Europe we see the

largest reduction in relative terms of the labor productivity gap (by three fourths). Differences in productivity measurement between the different data sets are smallest for Eastern Europe and Scandinavia. In Eastern Europe, labor productivity is with 45% of the US level still higher in LFS data than with 40% in NIPA data. Because of the extraordinary high labor productivity in Norway, on average Scandinavian labor productivity surpasses the one in the US based on both LFS and NIPA data, with the former being about 6 percentage points higher.

Summarizing, in terms of labor productivity Europe looks closer to the US based on LFS data than based on NIPA data. This is mostly driven by the closing of the rather small gap for Western Europe by three fourths and the large gap for Southern Europe by one third in LFS data compared to NIPA data. Scandinavian labor productivity surpasses US labor productivity in both LFS and NIPA data, whereas the difference between Western Europe and the US nearly disappears in LFS data. Southern and Eastern European labor productivity levels are significantly lower than in the US also in LFS data, amounting to three quarters and one half of the US level.

4.3 Implications for Macro Models of Taxation

A series of recent papers in the macroeconomic literature analyzing the driving forces of cross-country differences in *aggregate* hours worked focus on the role of taxes. How much does it matter for the conclusions which data source one uses for the analysis? For labor productivity measurement all hours counting towards the production of GDP should be included, and thus in principle NIPA data should be better suited than LFS data. However, for the analysis of the role of taxation for determining hours worked one could argue the opposite: if e.g. a large part of the institutionalized population does not have a meaningful choice of how many hours to work (e.g. the incarcerated population), then their hours should not be affected by taxation. In addition, residents working abroad are usually taxed by their home country.

To gain insights into the question in how far differences in tax rates can explain cross-country differences in hours worked per person, we follow the analysis in [Prescott \(2004\)](#) and incorporate taxes and lump-sum transfers into the neoclassical growth model. Each country is inhabited by a representative household that maximizes the present discounted value of future utility, with a utility function that is separable in consumption and leisure:

$$\max_{\{c_t, h_t\}_{t=0}^{\infty}} \sum_{t=0}^{\infty} \beta^t (\log c_t + \alpha \log(\bar{h} - h_t)), \quad (4)$$

where c_t is consumption, h_t hours worked, \bar{h} the total time endowment, and α determines the

relative disutility of work. The household budget constraint is given by

$$(1 - \tau_c)c_t + k_{t+1} = (1 - \tau_h)w_t h_t + (1 + r_t)k_t + T_t, \quad (5)$$

where τ_c is the consumption tax rate, τ_h is a linear labor income tax rate, k is capital, and T is a lump-sum government transfer.¹⁶ The government uses tax revenues to finance the lump-sum transfer. Last, there is a representative firm with a Cobb-Douglas production function

$$y_t = A_t k_t^\theta h_t^{1-\theta}. \quad (6)$$

Maximization by the household implies that the marginal rate of substitution between leisure and consumption equals their price ratio, and profit maximization by the firm that prices equal the marginal products. Combining these first order conditions, one can obtain optimal hours as

$$h_t = \frac{1 - \theta}{1 - \theta + \frac{c_t}{y_t} \frac{\alpha}{1 - \tau_t}} \quad (7)$$

with $\tau_t = \frac{\tau_h + \tau_c}{1 + \tau_c}$ being the tax wedge. Rather than solving the full dynamic model, [Prescott \(2004\)](#) interprets Equation (7) as the equilibrium value of hours worked given parameters and values for the consumption-output ratio. The consumption-output ratio, directly taken from the data, captures the dynamic component of the neo-classical growth model.

We calibrate the model and then assess its predictions for the Europe-US hours gap in the recent pre-crisis years 2005 to 2007. We take $\frac{c}{y}$ from the Penn World Tables 9.0 (see [Feenstra et al. \(2015\)](#)), specifically we set $\frac{c}{y} = csh_c + csh_g$,¹⁷ and following [Prescott \(2004\)](#) set the capital share $\theta = 0.3224$, the time endowment $\bar{h} = 52 \times 100$ hours, and the tax rate $\tau_t = \frac{\tau_{ss,t} + 1.6\tau_{inc,t} + \tau_{c,t}}{1 + \tau_{c,t}}$. $\tau_{ss,t}$ is the social security tax rate, and $\tau_{inc,t}$ is the average income tax rate, which is multiplied by 1.6 to obtain an average marginal tax rate. We use the tax rates from [McDaniel \(2012\)](#). Last, we calibrate the disutility of labor α to match average hours worked per person in the US, using the consumption to output ratio and the tax rate for the US. To predict hours worked in European countries, we assume that preferences are the same as in the US, but plug in country-specific values for the consumption to output ratio and the tax rates.

¹⁶We abstract for simplicity from investment and capital interest taxation, as well as capital depreciation, since they do not enter the static first order condition for the optimal hours choice.

¹⁷Note that consumption here refers to consumption by private households as well as by the government. Government consumption is thus treated as a lump sum transfer to households. [Prescott \(2004\)](#) subtracts from government consumption two times the military's share of employment times GDP, as he does not regard military expenditure as a substitute for private consumption. Since we do not have information on the military share of employment for all

Table 4: Europe-US Hours Difference (in %) in Data and Model

	LFS	NIPA
α	1.54	1.75
Data	-19.0	-7.1
Model	-10.1	-10.3
R²	0.16	0.14

Summary results are shown in Table 4, while the country-specific results are presented in Web Appendix Section W.5. The first column presents results when LFS hours are used for the calibration and subsequently for the comparison of model predictions to data from European countries, the second column presents results when we use NIPA hours. The first row shows the calibrated values of the disutility of labor α . Since US hours are higher in LFS data, α is lower when LFS data are used for the calibration. The second row repeats the Europe-US hours gap in the two different data sets. The next row gives the model predictions. It turns out that the different values of α have relatively small effects, such that the model predicts a very similar hours gap between Europe and the US based on both data sources. Through the lens of the neo-classical growth model differences in taxation and consumption to output ratios can thus account for 52% of the Europe-US hours gap when compared to LFS data (-10.1% in the model vs. -19% in LFS data). Evaluated against NIPA data, taxation and the consumption to output ratio account for more than the entire difference (-10.3% in the model vs. -7.1% in NIPA data).

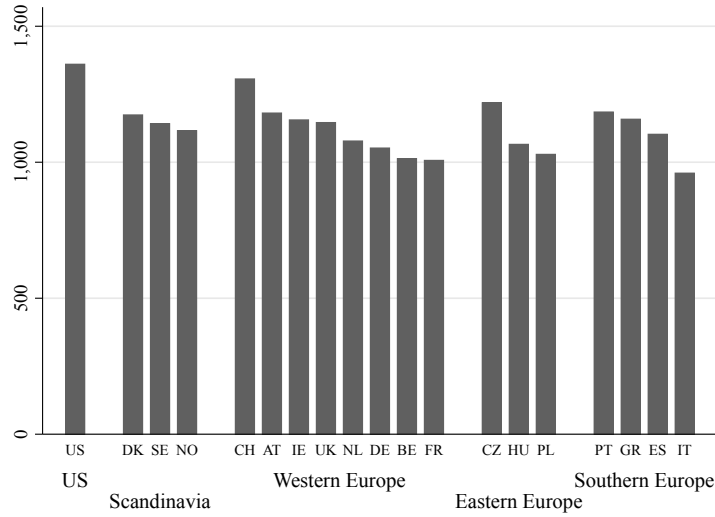
Put differently, while with NIPA hours taxes appear to be more than sufficient in accounting for the large Europe-US hours gap, with LFS hours taxes account for an important fraction of the gap, but leave ample room for other factors. Obviously, with a smaller labor supply elasticity than the one implied by Equation 4, the predicted Europe-US hours worked difference would be smaller, but the model would still perform better contrasted with NIPA data than with LFS data. Note that the model fit of the variation of hours *within* Europe is similar using both data sources as indicated by the R-squared in the last row.

5 Decomposing the Europe-US Hours Difference

In this section, we turn to the core question of the paper and investigate the role of different components of labor supply and the demographic and sectoral composition for hours worked differences

countries in our sample, we do not implement this adjustment.

Figure 8: Average Hours Worked per Person (2005-2007)



between Europe and the US, using LFS data from the recent pre-crisis cross-section 2005-2007 and covering the age group 15 to 64.¹⁸

Before we do this, we show in Figure 8 hours worked per person in the LFS data on the country level by geographic region. Within each region, we order countries by average hours worked per person. The US and Switzerland stand out with the highest hours worked per person, exceeding 1300, while Italians work less than 1000 hours per year. The mean hours worked per person within each European region are quite similar, ranging from 1102 hours in Southern Europe to 1144 hours in Scandinavia.

5.1 The Three Components of Hours Worked per Person

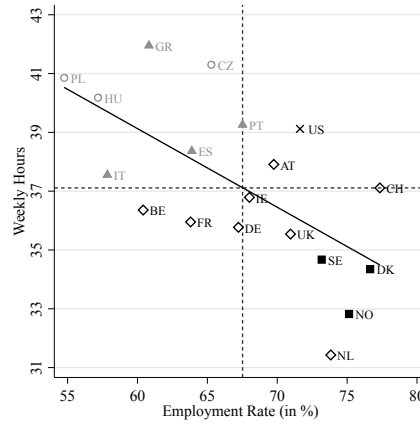
Average hours worked per person are the product of the employment rate and hours worked per employed, with the latter being a product of the weekly hours worked per employed in a non-vacation week and the number of weeks worked per year, i.e. $H = e \times h \times w$. Figure 9 shows how these three components relate to each other and reveals interesting patterns of heterogeneity across regions, despite the similar average hours worked per person across regions. The five regions are marked by different markers, namely the US by an x, Eastern Europe by a circle, Scandinavia by squares, Western Europe by diamonds, and Southern Europe by triangles.

Figure 9a plots weekly hours worked per employed in a non-vacation week (h) against the

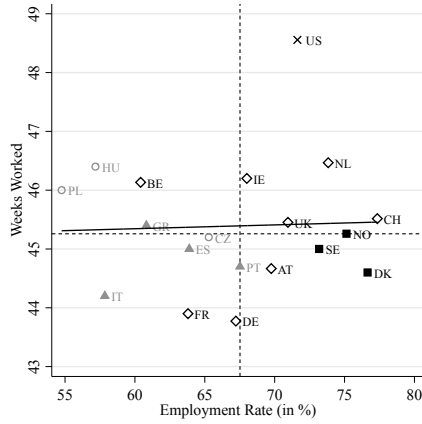
¹⁸In contrast to Sections 3 and 4, we use hours of anyone aged 15 to 64 in this section, not hours of anyone aged 15 or older as the NIPA data does. This accounts for the small differences between Figure 7 and Table 5.

Figure 9: Hours Worked Components

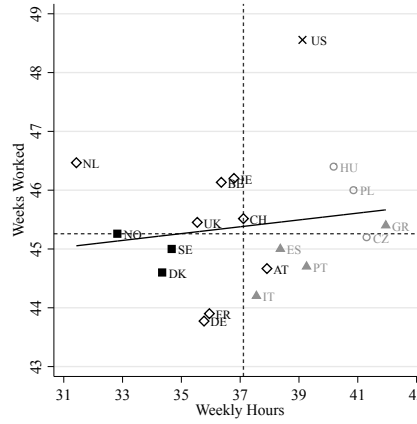
(a) Weekly Hours & Empl. Rate



(b) Weeks Worked & Empl. Rate



(c) Weeks Worked & Weekly Hours



employment rate (e), with the dotted vertical and horizontal lines indicating median values, and the solid line representing an OLS regression line. While hours worked per person do not differ much on average across the four European regions, as shown in Figure 8, a region-specific pattern for the relationship between the employment rate and weekly hours emerges. Eastern and Southern European countries all have above median weekly hours, but below median employment rates, with Portugal being the median country. The Scandinavian countries in turn have below median weekly hours and above median employment rates. Weekly hours worked per employed in the Western European countries are between those two groups of countries. Two exceptions are Austria with above median weekly hours and the Netherlands with the lowest weekly hours. The employment rates range from the fourth lowest in Belgium to the highest in Switzerland. Taken together, a strong negative cross-country correlation between weekly hours worked per employed and the

employment rate of -0.64 arises: countries with high employment rates tend to feature low weekly hours worked per employed in a non-vacation week, and vice versa.

Figure 9b plots the weeks worked (w) in a given country against the employment rate (e). Weeks worked range in Europe from below 44 in Germany and France to 46.5 in the Netherlands, with most of the cross-country variation coming from annual leave rather than public holidays (see Web Appendix W.2.1). The US clearly stand out with more than 48 weeks worked per year. Overall, the correlation between weeks worked and the employment rate is weak, amounting to 0.04 for all countries and -0.10 if the US is excluded. Figure 9c plots weeks worked (w) against weekly hours worked in a non-vacation week (h). Again, the correlation between both variables is rather small with 0.15 and drops further to 0.05 once the US is excluded. Web Appendix Section W.6.1 quantifies the contribution of the three components to explaining hours worked differences between the respective European country and the US, similarly to Alesina et al. (2005).

While we of course cannot make any causal statements based on our data, the results presented in Figure 9a to Figure 9c provide some information on potential driving forces of hours differences and give some guidance for modeling choices. They indicate that countries featuring high employment rates tend to feature low weekly hours worked per employed (and vice versa), while weeks worked are largely uncorrelated with both employment rates and weekly hours. The negative correlation between employment rates and weekly hours worked seems surprising: standard factors that influence labor supply, e.g. taxes, tend to influence both components in the same direction. Establishing this negative correlation in a quantitative model of labor supply is therefore not trivial. The reasons for the negative correlation between employment rates and weekly hours worked could potentially stem from the employee's side, the employer's side, or from regulation. In Bick and Fuchs-Schündeln (2016), we e.g. document a similar negative correlation for married women aged 25 to 54, and provide some suggestive evidence that it might be driven by differences in part-time regulation across countries.

The absence of any correlation between weeks worked and employment rates or hours worked, on the other hand, seems to indicate that more public holidays or annual leave, i.e. less weeks worked per year, neither induce systematically more people to work nor to work longer hours during a non-vacation week. Weeks worked (or the reverse, namely vacation weeks) thus potentially seem to be determined by other forces than those determining employment rates and weekly hours worked. These could e.g. be institutional factors, like historic unionization rates. Moreover, weeks worked do not seem to influence the individual decision whether to enter the labor force and how many hours to work. This would call for modeling weeks worked differently than employment and hours worked per week. One could e.g. follow the model in Kaplan (2012), who introduces a

model in which involuntary unemployment (in our case vacation weeks) determines the number of weeks worked per year, and agents choose only hours worked per work week optimally. Assuming separability in the utility function between weeks worked and hours worked per week in such a model could lead to a zero correlation between weeks worked per year and either employment rates or weekly hours worked per employed.

5.2 Disaggregate Decomposition

Countries in our sample differ not only in the three components of labor supply, but also in their demographic structure, i.e. the composition of the population by demographic characteristics. We take into account three demographic characteristics, namely gender, age, and education, as well as the sectoral composition of employment in a country. Explicitly accounting for these groups, we can write aggregate hours worked per person in country c as

$$H^c = \sum_j^J f_j^c e_j^c \times \sum_k^K s_{j,k}^c h_{j,k}^c \times w^c, \quad (8)$$

where j represents a set of demographic characteristics and k the sector of employment. f_j^c is the fraction of individuals with a given set of characteristics j (with $\sum_{j=1}^J f_j^c = 1$), e_j^c is the employment rate of group j , $s_{j,k}^c$ is the share of employed individuals of group j working in sector k (with $\sum_{k=1}^K s_{j,k}^c = 1$), $h_{j,k}^c$ are the weekly hours worked per employed in a non-vacation week by group j in sector k , and w^c are the weeks worked (non-vacation weeks). Each group j is defined by the interaction of one of three age groups (15-24, 25-54, 55-64), three education groups (low, medium, high), and gender. Only for the young age group, we allow a fourth educational category “still enrolled in education”. As a result, there are 20 groups j . Since only employed individuals can be allocated to a sector, the sectoral composition only affects hours worked per employed, not the employment rate. We consider the three sectors services, manufacturing, and agriculture.¹⁹ Last, remember that in the baseline analysis we assume the same number of weeks worked for everyone, an assumption we relax below.

To quantify the contribution of the three components of labor supply, the demographic composition, and the sectoral composition to the difference of the country-specific hours relative to the US, we calculate counterfactual hours by setting for every country one of these five features after the other equal to the corresponding US value. We then measure the incremental fraction of the aggregate hours worked per person difference relative to the US accounted for by this feature.²⁰

¹⁹Defining self-employment as an own “sector” does not affect the results in a substantial way.

²⁰Web Appendix Section W.6.1 describes the procedure in detail focusing only on the three components of labor

The quantitative results depend on the order in which the features are set country specific. With five features, there are 120 different possible orderings, and we report the mean results over all 120 different orderings. This decomposition is somewhat similar in spirit to the one done by [Blundell et al. \(2011\)](#) and [Blundell et al. \(2013\)](#) for time-trends in hours in the France, the UK, and the US.

Demographic groups (or the sectoral composition) matter in the decomposition analysis only if two conditions are met: first, the composition across countries needs to be different. E.g. since in all sample countries and years women make up around 50 percent of the population aged 15 to 64, applying the gender composition of the US to a country will not affect the corresponding hypothetical estimate of aggregate hours worked per person. Secondly, the demographic groups need to exhibit either different employment rates or different weekly hours worked *within* a country. E.g. even if the educational composition is different across countries, if low, medium, and high educated people were to participate in the market to the same degree and exhibit the same weekly hours worked within a country, applying the US educational composition would have no effect on the corresponding hypothetical estimate of aggregate hours worked per person. Note that by applying all possible orderings of the components in the decomposition (i.e. sometimes the demographic structure is set to the US level before hours and/or employment rates, sometimes afterwards), the groups could behave differently either in the US or in the respective European country for the demographic composition to play a role.

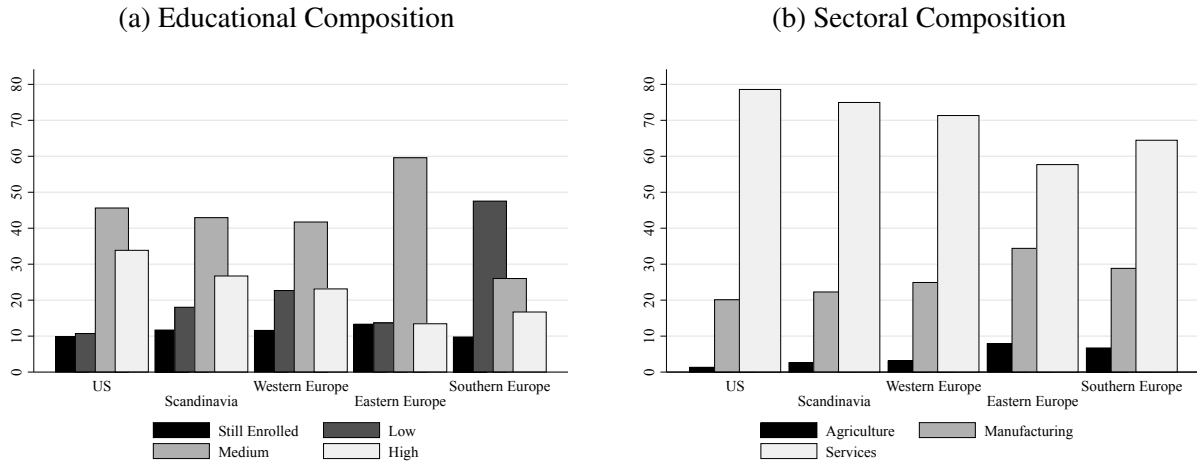
With regard to the demographic composition, not only is the gender composition very similar across countries, but the age composition, referring to individuals aged 15-24, 25-54, and 55-64, is relatively similar as well (as can be seen in Web Appendix Figure [W.42](#)). The same is however not true for the educational composition, which Figure [10](#) shows in the left panel. The US stands out with the lowest (highest) share of low (high) educated individuals with 11% (above 30%), whereas in Eastern and Southern Europe less than 20% of the population have high education. Eastern Europe exhibits the highest share of medium educated individuals, amounting to almost 60%, while Southern Europe features the highest share of low educated individuals, amounting to almost 50%. The fraction of young adults still enrolled in education is with 10 to 15% rather similar across regions. The different levels of education are defined according to the ISCED classifications, with “low” corresponding to lower secondary education, “medium” to upper secondary education, and “high” comprising any tertiary education degree.²¹

The right panel of Figure [10](#) shows the sectoral composition across regions. The share of employed people working in services is highest in the US with 79 percent, followed by Scandinavia

supply analyzed in the previous subsection.

²¹For example, for the US “low” corresponds to less than high school education, “medium” to completed high school education, and “high” to having at least an associate’s degree.

Figure 10: Demographic Structure



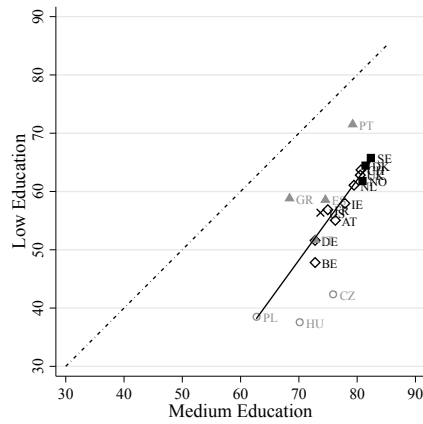
and Western Europe, which still exhibit shares above 70 percent. It is however significantly lower in Southern Europe with 64 percent, and especially in Eastern Europe with 58 percent.²² The low share in services in Eastern and Southern Europe is offset by both a higher share of individuals working in manufacturing, and a slightly higher share working in agriculture. The share of employed people working in agriculture is however very low everywhere, reaching its maximum with 8 percent in Eastern Europe.

While the sectoral and the educational compositions thus differ significantly across countries, this only has an effect in the disaggregate decomposition if different educational groups show different labor market behavior within a country, and individuals in different sectors work different hours. Panels (a) to (d) in Figure 11 show the corresponding evidence for education groups: there are indeed substantial differences in employment rates of low, medium, and high educated individuals within a country for all countries (panels (a) and (b)), but rather small differences in weekly hours worked (panels (c) and (d)). On average across all countries, medium educated individuals have a 20 percentage points higher employment rate than low educated individuals, but a 9 percentage points lower one than high educated individuals. By contrast, the differences in weekly hours are with on average 1.5 hours between low and medium, and 0.6 hours between medium and high educated individuals small. Panels (e) and (f) show that differences in weekly hours between individuals working in different sectors are somewhat larger than between individuals with different education levels: individuals working in the manufacturing sector work on average 3.1 more weekly hours than individuals in the services sector. Individuals working in agriculture work even longer weekly hours, especially in the Western European countries, but their share there is

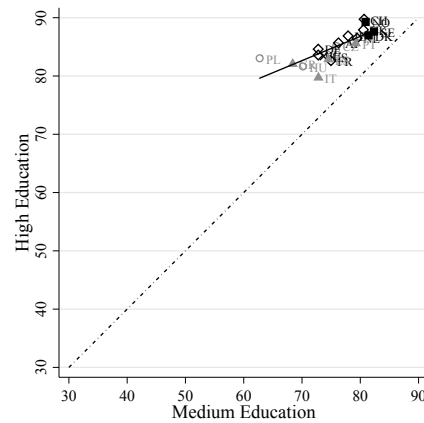
²²Rogerson (2008) documents the historically lower employment share in services in Europe than in the US.

Figure 11: Labor Supply Broken Down by Education or Sector

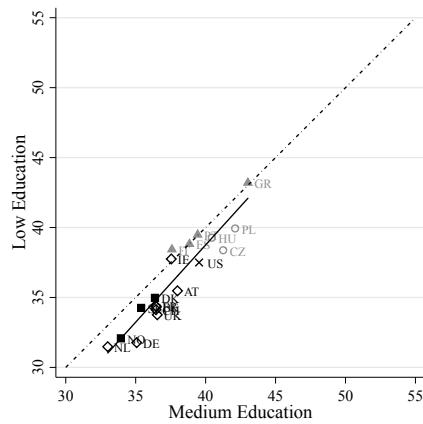
(a) Employment Rate: Low & Medium



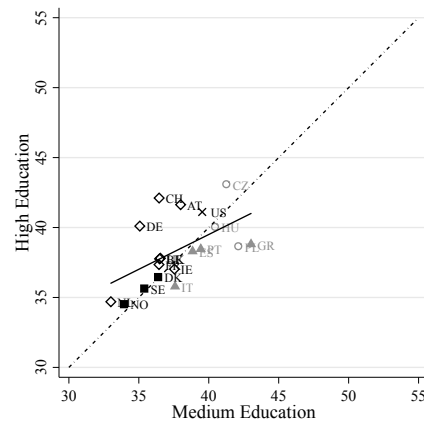
(b) Employment Rate: High & Medium



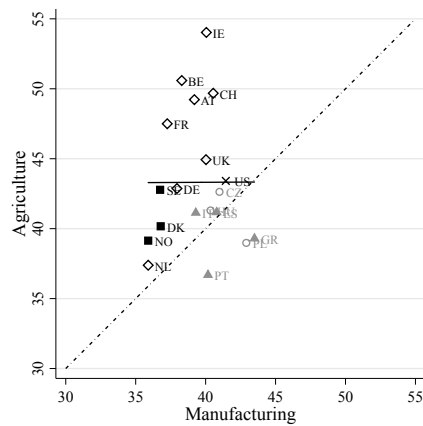
(c) Weekly Hours: Low & Medium



(d) Weekly Hours: High & Medium



(e) Weekly Hours: Agriculture & Manufacturing



(f) Weekly Hours: Services & Manufacturing

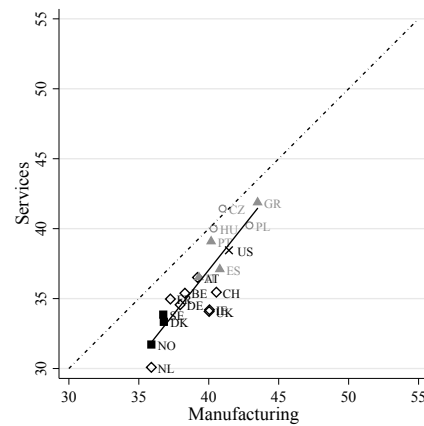
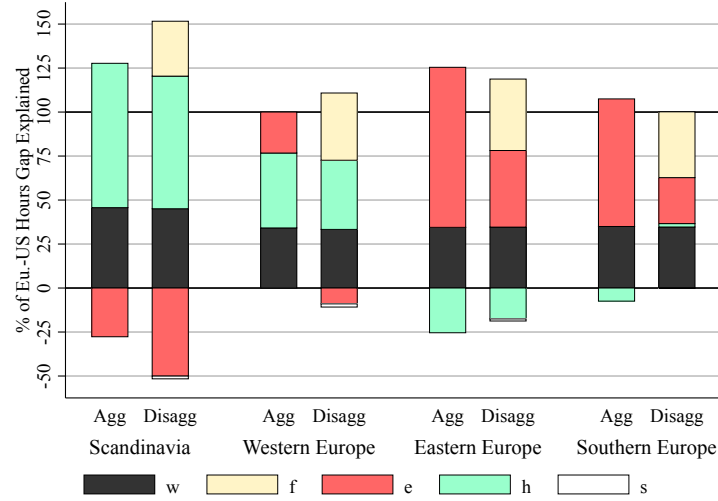


Figure 12: Aggregate and Disaggregate Decomposition



Note: Each part of a bar represents the fraction of the country group-US hours gap explained by the respective component. All parts of a bar add up to 100%. The averages for Western and Southern Europe exclude Switzerland and Portugal, respectively.

too small to affect the aggregate.

The consequences of these findings on the decomposition of cross-country differences in hours worked per person are shown in Figure 12. To facilitate the comparison, we show only averages over the regions (excluding Switzerland from Western Europe and Portugal from Southern Europe for reasons explained below) and also show the corresponding results from an aggregate decomposition that only analyzes the importance of the three components of labor supply, but omits the demographic and sectoral composition, i.e. the results presented in Web Appendix Section W.6.1. In this figure, the difference in hours worked per person with the US is divided into the fraction explained by weeks worked w , employment rates e , weekly hours h , the demographic composition f , and the sectoral composition s . The two latter components only show up in the disaggregate composition, which is presented in the right bar for each country group, but not in the aggregate composition in the left bar. If a factor does not positively contribute to the overall difference, but in fact indicates higher hours in the European region than in the US, this is indicated by a negative entry.

The demographic structure f accounts for a substantial fraction of the hours worked per person differences relative to the US in all European regions. Put differently, the demographic composition in Europe predicts substantially lower hours than in the US. Introducing the demographic structure reduces the importance of the employment rate in all regions significantly. The share

explained by the employment rate even turns from positive to negative in Western Europe. By contrast, there are only minor changes in the share of the Europe-US hours difference explained by weekly hours when the demographic and sectoral structures are introduced in the disaggregate decomposition. These two results are due to the fact that employment rates increase substantially by education in all countries, whereas weekly hours are similar for the three educational groups within each country. Thus, not accounting for the higher share of low- or medium-educated individuals in Europe than in the US attributes too much importance to employment rates.²³ While weekly hours worked differ more by sectors than by education groups, the differences across sectors within each country are still relatively small, and as a result the sectoral composition is a negligible factor in explaining the Europe-US hours gap. Note that in our decomposition the sectoral composition can only affect hours worked per person through differences in weekly hours worked per employed between sectors, since we cannot assign non-employed individuals to a sector. Rogerson (2008) stresses the importance of an underdeveloped service sector in Europe for explaining low hours there. In his model, high tax rates in Europe induce individuals to specialize in home production, leading to a stagnating service sector instead of a growing one as in the US, since services produced in the market are closer substitutes to services produced at home than goods produced in the market to goods produced at home. As far as this channel works through drawing less people into employment, it is not captured in our decomposition which by construction can only handle sectoral differences in weekly hours worked.

The full disaggregate decomposition results are shown in Table 5. It reports in column 1 the hours worked per person difference relative to the US, i.e. $(\frac{H^c - H^{US}}{H^{US}}) \times 100$. In column 2 we report what fraction of the difference in hours worked per person with the US can be accounted for by differences in the number of non-vacation weeks w . Columns 3 to 6 report the same statistic for the demographic composition f , employment rates e , weekly hours worked h , and the sectoral composition s , respectively. The five last columns add up to 1. A positive value indicates that a factor positively accounts for the (negative) difference, while a negative value means that the respective factor does not contribute to the (negative) difference, but would in fact indicate higher hours in the respective European country than in the US. As an example, Scandinavians work on average 16% lower hours worked per person than US Americans. 75% of this difference can be accounted for by lower weekly hours worked, 45% by a lower number of weeks worked, and 31% by the demographic structure. At the same time, employment rates are larger in Scandinavia than in the US (see Figure 9a). This is not entirely accounted for by the demographic structure, and

²³Using only gender and age to define a demographic group yields results very similar to using the aggregate data only (not shown here).

Table 5: Disaggregate Decomposition

Country	$\frac{H^c - H^{US}}{H^{US}}$	Δ^w	Δ^f	Δ^e	Δ^h	Δ^s
Denmark	-13.7	56.5	39.6	-66.1	73.3	-3.3
Sweden	-16.1	43.0	32.1	-43.5	68.4	0.0
Norway	-18.0	35.7	21.9	-40.5	84.3	-1.4
<i>Mean</i>	<i>-15.9</i>	<i>45.1</i>	<i>31.2</i>	<i>-50.1</i>	<i>75.3</i>	<i>-1.6</i>
Switzerland	-4.0	160.9	86.1	-240.9	103.3	-9.4
Austria	-13.2	59.2	39.8	-13.7	21.3	-6.6
Ireland	-15.0	26.2	56.8	-16.1	42.9	-9.8
United Kingdom	-15.8	37.7	51.3	-38.3	50.0	-0.7
Netherlands	-20.8	18.4	35.4	-33.7	71.7	8.3
Germany	-22.6	40.7	23.5	5.7	31.8	-1.8
Belgium	-25.5	17.5	30.0	24.1	28.9	-0.5
France	-26.0	33.5	30.6	8.8	28.6	-1.5
<i>Mean</i>	<i>-17.9</i>	<i>49.3</i>	<i>44.2</i>	<i>-38.0</i>	<i>47.3</i>	<i>-2.8</i>
<i>Mean w/o CH</i>	<i>-19.8</i>	<i>33.3</i>	<i>38.2</i>	<i>-9.0</i>	<i>39.3</i>	<i>-1.8</i>
Czech Republic	-10.4	65.4	50.4	21.9	-36.7	-1.0
Hungary	-21.6	18.7	39.4	49.1	-5.7	-1.6
Poland	-24.4	19.7	32.0	59.6	-10.3	-1.0
<i>Mean</i>	<i>-18.8</i>	<i>34.6</i>	<i>40.6</i>	<i>43.5</i>	<i>-17.6</i>	<i>-1.2</i>
Portugal	-12.9	58.5	89.9	-43.3	-4.6	-0.5
Greece	-14.9	41.5	40.5	45.5	-29.0	1.6
Spain	-19.1	35.7	38.2	11.0	16.4	-1.3
Italy	-29.4	26.8	33.5	21.9	18.4	-0.6
<i>Mean</i>	<i>-19.1</i>	<i>40.6</i>	<i>50.5</i>	<i>8.8</i>	<i>0.3</i>	<i>-0.2</i>
<i>Mean w/o PT</i>	<i>-21.1</i>	<i>34.7</i>	<i>37.4</i>	<i>26.1</i>	<i>1.9</i>	<i>-0.1</i>

Note: Columns 2 to 6 indicate what fraction (in %) of the hours worked per person difference to the US in column 1 is accounted for by the corresponding factor given in the column header. Columns 2 to 6 sum up to 100 for each country.

hence the differences in the employment rate cannot account for why hours worked per person are lower in Scandinavia than in the US, and that causes a negative entry in the table. Scandinavian hours worked per person would actually be 8% (-0.16×-0.50) larger than US hours based on the employment rate differences after controlling for the demographic structure, rather than 16% lower.

Weeks worked w and the demographic structure f uniformly predict lower hours in Europe than in the US. Weeks worked account on average over the European regions for one third to one half

of the lower hours, and the demographic structure for another one third to one half. Differences in the sectoral compositions play no significant role in explaining hours differences to the US in any of the European countries. After controlling for the demographic and sectoral compositions in this decomposition exercise, we still observe marked patterns in the relative importance of employment rates and weekly hours: in Scandinavia and Western Europe, weekly hours worked are the main driver of lower hours per person compared to the US, explaining a share of 75 and 39 percent, respectively, with the employment rate going substantially in the opposite direction by 50 percent in Scandinavia, and slightly by 9 percent in Western Europe. Note that we exclude Switzerland from the Western European average when discussing the results, because it features very high values in the decomposition table because of its small difference in hours worked per person to the US of only -4%.²⁴

While weekly hours universally point to lower hours in all Scandinavian and Western European countries, though by varying degree, the employment rates do not universally indicate higher hours, with Belgium, France, and Germany being exceptions to this rule. In contrast to Scandinavia and Western Europe, employment rates indicate lower hours worked per person in Eastern and Southern Europe except Portugal, explaining on average 44 and 26 percent of the hours difference to the US, respectively. Portugal is the stark exception here, with employment rates indicating substantially higher hours than in the US. Weekly hours go in the opposite direction in Eastern and Southern Europe, indicating higher hours than in the US, with the exception of Spain and Italy. For Spain and Italy, weekly hours and employment rates are both roughly equally important in explaining the hours gap to the US. In Portugal, lower hours are entirely driven by a lower number of work weeks and the demographic decomposition. Overall, the results in Table 5 make clear that the negative cross-country correlation of the two components employment rates and weekly hours is not primarily driven by differences in the demographic or sectoral compositions, but by some more fundamental factors that apply to all groups in the labor market.

By definition, the importance of work weeks is not affected by the demographic or sectoral decomposition, as we impose the same number of work weeks for all subgroups within a country. We relax this assumption in Web Appendix Section W.6.3, where we allow for heterogeneity in weeks worked as described in Web Appendix Section W.2.5 by scaling the reported vacation weeks in the LFS data of each gender \times age \times education \times sector group up by a common multiplicative factor such that the average vacation weeks match the ones from external data sources. This procedure (rather than assuming a common additive factor, or scaling up weeks worked rather than

²⁴Remember that the hours differences to the US in this section are slightly different than the hours differences to the US presented in Figure 7, because in this section we include only hours of individuals aged 15 to 64, not hours of all working individuals aged 15 and above; see footnote 18.

vacation weeks) maximizes the degree of heterogeneity. Web Appendix Table [W.18](#) shows the results. While the results are almost unchanged for Scandinavia and Western Europe, allowing for heterogeneity in weeks worked by demographic group reduces the importance of the demographic composition in Eastern and Southern Europe by 9 and 14 percentage points, respectively, which is nearly completely offset by a corresponding increase in the importance of weeks worked.

Summarizing, there are three main findings from the disaggregate decomposition analysis. First, more vacation weeks alone account uniformly across Europe for between one third to one half of the hours difference to the US. Secondly, there exist large differences across Europe in the relative contribution of employment rates and weekly hours in explaining the hours difference to the US even after controlling for differences in the demographic and sectoral composition. For Scandinavia and Western Europe, lower weekly hours worked explain three quarters and roughly 40 percent, respectively, of the lower hours than in the US, with employment rates indicating higher hours than in the US. For Eastern and Southern Europe (excluding Portugal), by contrast, lower employment rates explain roughly one half and one quarter, respectively, of the lower hours than in the US, and weekly hours worked tend to be higher than in the US. Understanding the roots of these differences constitutes an interesting new research agenda. Third, differences in the educational composition constitute an important driving force of hours worked differences across countries: the different educational composition, with a higher share of low and medium educated people in Europe, accounts for one third to one half of the differences in hours worked per person, similarly to weeks worked. Not taking the educational composition into account would overestimate the importance of the employment rate in explaining lower hours in Eastern and Southern Europe, and would underestimate the degree to which employment rates indicate higher hours in Scandinavia and Western Europe than in the US.

The results point to the importance of studying the educational composition as a driving force of hours worked differences across countries. Which policies or other factors determine the different educational compositions across countries? For example, [Restuccia and Vandenbroucke \(2014\)](#) analyze the role of longevity and economic growth on the educational composition across countries and over time. Note that some of these policies affecting educational choices could affect hours worked directly at the same time. [Guvenen et al. \(2014\)](#), while not distinguishing between employment and hours per employed, show that progressive taxation distorts the incentives to invest in human capital, and that these tax differences can explain a sizable part of the differences in the Europe-US hours per person gap for men. Also, the results point to the importance of understanding why employment rates increase strongly with education within a country, but hours worked per employed do not. Policies that affect the incentives to work differentially by education could e.g.

be welfare systems, or different degrees of flexibility in the labor markets for rich and poor, e.g. due to a minimum wage being binding for the poor. Moreover, the disutility of work could differ in low- and high-education jobs. Yet, one would have to investigate if these factors influence the extensive margin more than the intensive one. In this regard, we want to mention the caveat that categorizing educational groups across countries in a consistent way is far from trivial, given the vastly different educational systems across countries.

6 Conclusion

In this paper, we document the construction of a new data set of aggregate hours worked starting from labor force surveys. This data set allows to analyze which fraction of the Europe-US hours analysis is driven by the different components of labor supply, as well as the role of the demographic and sectoral composition. We rely on data from the US Current Population Survey, the European Labor Force Survey, and the German Microcensus to construct hours worked measures. The main challenges for comparability of the several surveys at a given point in time across countries, or for a given country over time, regard the sampling of reference weeks over the year and the underreporting of vacation weeks. We show that we overcome both problems by obtaining hours worked in a *non-vacation* week, i.e. a work week without a reduction in work time because of a public holiday or annual leave, and requiring consistency of annual leave and public holidays in the micro data with the country-wide average. Information on the latter is collected from external data sources. While time trends in LFS and NIPA data are similar, we document substantial differences in the level of the Europe-US hours gap in both types of data sources. In the LFS data, Europeans work on average 19% fewer hours than Americans in the recent pre-crisis period 2005 to 2007, compared to only 7% in NIPA data. The likely reasons lie less in the slightly different coverage of the population, but more in the country-specific kinds of data sources and methodologies used to construct NIPA hours, which might inhibit the international comparability. The differences between LFS and NIPA data are large enough to matter for the measurement of labor productivity and the explanatory power of taxation for hours differences across countries.

In the main part of the paper, we decompose hours worked differences between Europe and the US into weeks worked, employment rates, and weekly hours worked per employed in a non-vacation week, as well as the role of the demographic and sectoral composition in accounting for these differences. Weeks worked and the demographic composition, driven by the educational composition, both account for between one third and one half of the lower hours in Europe than in the US. Weekly hours worked account for three quarters and roughly 40 percent of the lower hours

in Scandinavia and Western Europe, respectively, where employment rates contribute negatively to explaining the hours gap to the US. By contrast, employment rates account for roughly one half and one quarter, respectively, of the lower hours in Eastern Europe and Southern Europe without Portugal, with weekly hours worked mostly contributing negatively to the difference.

Our results indicate new avenues in the research agenda of the study of hours worked differences across Europe and the US. First, they show that the higher number of vacation weeks in Europe is a significant driver of lower hours, and that longer vacation weeks are not associated with either higher employment rates or longer weekly hours worked. This might indicate that the number of work weeks is determined by other driving factors than those determining employment rates and weekly hours worked, and raises the question whether they should be modeled as a choice variable for the individual. Secondly, we document a negative correlation between weekly hours worked and employment rates across countries that is not entirely driven by differences in the sectoral or educational composition. Modeling this negative correlation is not trivial, and investigating the sources is a promising research agenda. Third, the educational composition matters significantly in accounting for cross-country differences in hours worked through its effect on employment rates. Understanding why different education groups exhibit such different employment rates (but not weekly hours worked), and different countries have such different educational compositions, will thus be a helpful step in explaining hours worked differences across countries.

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Web Appendix

Hours Worked in Europe and the US: New Data, New Answers

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W Web Appendix

W.1 Construction of Hours Data from Labor Force Surveys

W.1.1 Dropped Observations

We drop some observations from the sample due to missing values. If actual hours are missing for employed respondents, we replace them by zero if the respondent indicates not having worked in the reference week. If the respondent states that he/she has been working in the reference week, but actual hours are missing, we drop the observation. Observations with missing usual hours are only dropped when we need usual hours to calculate hours worked, see subsection 2.4 for details. Table W.1 shows the percentage of observations dropped due to the different reasons. With the exceptions of Belgium and Switzerland, the percentages are far below 1 percent.

There are a number of country/year observations that have been dropped in the calculation of averages due to different inconsistencies and particularities. Specifically, we exclude the years 1983 for Denmark, 2001 for the UK, and 2005 for Spain from our analysis. The Danish data for 1983 suggest that only around 23 percent of all observed individuals were employed, which is around one third of the employment rate that we observe in other years. In the UK in 2001, 3.2 percent of the respondents report not having worked at all in the reference week despite having a job due to bad weather (“other” reasons), compared to around 0.03 percent before and after 2001. By contrast, in 2001 only 0.32 percent report not having worked in the reference week despite having a job due to annual leave, compared to more than 3 percent in 2000 and 2002. This suggests that the categories have been switched accidentally, but since we cannot be certain, we do not include 2001 into our analysis. For Spain, the fraction of people reporting having worked less than usual due to compensation leave is with 3.4 percent extraordinarily high compared to 2004 and 2006 (less than 0.03 percent in both years). As a result average hours lost due to “other” reasons are seven times larger in 2005 than in the previous and subsequent years (2.8 as opposed to 0.4), which ultimately leads to a large drop in hours worked in 2005. We found this change so unusual

Table W.1: Average Fraction of Observations Dropped Because of Missings in Usual or Actual Hours Worked (in %, all years)

Country	$h_{act} = .$ and set to zero	$h_{act} = .$ and dropped	$h_{usu} = .$ and dropped
Denmark	0.00	0.54	0.01
Norway	0.97	0.81	0.04
Sweden	0.00	0.08	0.00
<i>Mean</i>	<i>0.32</i>	<i>0.48</i>	<i>0.02</i>
Austria	0.25	0.00	0.00
Belgium	0.00	1.41	0.03
France	0.00	0.05	0.01
Germany	0.00	0.00	0.00
Ireland	0.00	0.30	0.00
Netherlands	0.00	0.52	0.00
Switzerland	0.00	2.05	0.00
United Kingdom	0.00	0.90	0.01
<i>Mean</i>	<i>0.03</i>	<i>0.65</i>	<i>0.01</i>
Czech Republic	0.00	0.17	0.00
Hungary	0.00	0.02	0.00
Poland	0.00	0.10	0.12
<i>Mean</i>	<i>0.00</i>	<i>0.10</i>	<i>0.04</i>
Greece	0.00	0.01	0.00
Italy	0.01	0.14	0.00
Portugal	0.00	0.48	0.01
Spain	0.00	0.68	0.01
<i>Mean</i>	<i>0.00</i>	<i>0.33</i>	<i>0.01</i>
US	2.42	0.39	0.20

that we decided to drop 2005 for Spain.

Table W.2 gives the final total sample size of individuals aged 15-64, for each country/year combination. The annual sample size per country ranges from 10,000 to 450,000 observations with an average of 111,000 observations. Note that for Germany, we use the Microcensus until 2001 and then switch to the ELFS as soon as it is available in 2002. This is also visible in the sample size which drops from 340,000 to 210,000 between 2001 and 2002. In 2006, Germany's sample size decreases even further from 300,000 in 2005 to 32,000 in 2006. Similar drops occur in France in 2003 (110,000 to 55,000) or Spain in 2006 (120,000 to 70,000). For most countries, we see an increase in sample size that coincides with the switch to continuous surveying.

Table W.2: Final Sample Size, Individuals Aged 15-64, Part 1

Year	Belgium	Denmark	France	Germany	Greece	Ireland	Italy	Netherlands	Portugal	Spain	United Kingdom	US
1983	71106	–	104800	–	80661	84597	222945	110693	–	–	137949	293223
1984	29413	19415	106242	–	91681	89464	230151	–	–	–	105106	289019
1985	60804	19821	106487	303863	91867	90676	223136	107118	–	–	106409	288542
1986	54186	18591	105463	–	92171	89780	222753	–	59098	128768	106717	282810
1987	49152	18407	106881	305693	93192	91013	237109	35103	57850	120401	104823	281228
1988	51087	17793	107535	–	94192	89977	238476	52160	57351	128927	106626	266234
1989	48450	18691	108020	265745	93048	90527	258153	54459	54678	130375	106607	269559
1990	48009	18853	105893	–	93271	90202	258764	52877	54546	132278	102994	283563
1991	49854	19279	105914	352462	92380	90235	130290	52309	55271	131593	101466	280001
1992	50111	17953	107691	–	90788	93697	137370	53592	32222	130074	100113	275042
1993	51357	19576	112283	349187	112590	92749	136621	51610	32636	126612	101991	270768
1994	51432	11480	115299	–	110089	92408	135404	57438	31845	127268	98985	263369
1995	50545	11225	115257	345465	108555	92832	138114	61021	29699	129209	96051	260273
1996	51419	11146	114278	343270	108795	91637	136776	54693	29533	129376	95019	230148
1997	50465	11002	112160	343871	107759	94167	136315	62782	29534	128514	91624	232887
1998	50831	10972	112808	342754	56220	72439	136325	39115	32749	128966	89468	233029
1999	17212	10639	113230	341589	55238	72205	135308	36429	30812	132046	88718	235273
2000	17062	10763	113621	338031	53669	70129	134892	48178	29594	121626	85849	236168
2001	16056	10509	111631	336765	52735	69923	131656	64988	29743	116583	–	252663
2002	18140	10582	109689	212827	50305	70378	129271	69641	29405	115254	84286	274879
2003	18082	10001	55759	213758	47349	67712	127244	69411	30027	117254	80871	273909
2004	18593	10024	56289	210703	52268	57276	110413	82160	33109	116925	77417	269087
2005	73692	37864	219384	304568	200842	60590	448246	343516	123711	–	76367	268752
2006	76889	36787	216427	31650	192420	56970	434234	77719	116170	68048	74700	266688
2007	76217	73656	224295	31366	186256	56643	426063	76256	110960	69017	74170	264106
2008	72462	70657	223226	30283	184897	49292	420881	78729	107887	70328	119280	262758
2009	71063	73216	264813	31538	188855	179531	409672	68640	104944	72958	58743	265326
2010	70520	84449	315206	29818	192444	160114	409654	59932	103056	72978	56983	264798
2011	65855	89419	325751	30437	171442	146444	399728	64049	100490	69884	53874	260936

Table W.3: Final Sample Size, Individuals Aged 15-64, Part 2

Year	Austria	Norway	Sweden	Hungary	Switzerland	Czech Republic	Poland
1995	40193	19687	15739	—	—	—	—
1996	40047	18860	14673	43489	12536	—	—
1997	39760	18923	14497	42709	12538	48286	44719
1998	41358	18399	14234	57007	12589	47805	45815
1999	41005	18529	16305	58616	13619	46817	44374
2000	39502	18846	15824	56627	13604	44717	38378
2001	39819	18070	48005	56361	14121	44195	39226
2002	39438	18772	53146	55331	30451	42772	39878
2003	37920	18846	53499	59285	44451	41728	39735
2004	30144	19183	48922	55590	41599	43216	39305
2005	136572	76989	138313	209830	39248	171815	154607
2006	133522	18571	196331	209593	36435	174527	148977
2007	134016	18623	193607	204599	36634	172614	142281
2008	129481	17919	190039	193973	35526	164990	142666
2009	124005	18000	183925	192955	36195	159491	146366
2010	121121	17520	240485	189002	48288	157048	286657
2011	120696	17252	232441	188869	51354	30259	291083

Table W.4: Reference Weeks in ELFS

Country	Non-Continuous Surveying		Continuous Surveying of Reference Weeks		
	Years	Weeks*	Only Subset Available Years	Weeks†	All Weeks Available Since
Austria	1995-2003	9-14	2004	1-13	2005
Belgium	1983-1998	17	1999-2004	14-26	2005
Czech Republic			1997-2004	10-22	2005
Denmark	1983-1993	5-23	1994-2004	14-26	2005
France	1983-2002	9-14	2003-2004	1-13	2005
Germany	1985-2004	13			2005
Greece	1983-1997	13-28	1998-2004	14-26	2005
Hungary	1996-2002	15-24	2003-2004	16-26	2005
Ireland	1983-1997	14-21	1998-2008	10-22	2009
Italy	1983-2003	13	2004	14-26	2005
Netherlands	1983-1999	1-22	2000-2004	14-26	2005
Norway	1995-1995	16-22	1996-2004	14-26	2005
Poland	1997-1999	7	2000-2004	14-26	2005
Portugal	1986-1997	16-25	1998-2004	14-26	2005
Spain	1986-1998	13-24	1999-2004	14-26	2005
Sweden	1995-1999	5-17	2000-2004	5-17	2005
Switzerland	1996-2009	13-26			2010
United Kingdom	1983-1991	8-20	1992-2007	10-22	2008

Note: * Weeks refer to last years under non-continuous surveying; † Weeks refer to first years under continuous surveying.

W.1.2 Distribution of Reference Weeks

Table W.4 shows for each country

- the years in which only a subset of weeks was sampled along with the weeks sampled (non-continuous surveying)
- the years in which all weeks were sampled but Eurostat makes only a subset of weeks available, and which weeks those are
- from which year onwards all weeks are available.

In most countries, all weeks are available from 2005 onwards, and for the in-between period usually the weeks of the second quarter are available. There are however several exceptions to these rules, which we list in the next paragraph.

When **Austria** changed to continuous surveying in 2004, the ELFS did not cover the second, but the first quarter of the year. In the **Czech Republic**, the change to continuous reference weeks officially took place in 1992. We have only data starting from 1997, with reference weeks covering

Table W.5: Absolute %(-point) Deviations of $H^{E,raw}$, e , and H^E from Annual Mean Using Only Second Quarter

	Mean	75th	90th	95th	99th	Max
$H^{E,raw}$	2.8	4.3	5.4	6.2	7.0	7.5
e	0.4	0.5	0.8	1.1	1.2	1.9
H^E	0.6	0.9	1.3	1.6	1.8	2.0

the second quarter until 2005. Mostly this means that weeks 14 to 26 are covered, while in the Czech LFS of 1997 and 1998, the data covers the 12 weeks starting from week 10. Similar to Austria, the ELFS for **France** covers the first quarter instead of the second one after the actual change in reference weeks in 2003. This was also the year where the change occurred in **Hungary**, where observations then start to cover the late second quarter (starting in week 16 instead of 14), with observations being very unequally distributed over the weeks. ELFS documentation says that **Ireland** switched to a continuous survey in 1998, but the reference weeks in the ELFS up until and including 2008 only cover the second quarter of the year and shift to covering all weeks in 2009. In **Poland**, the switch from one reference week to continuous coverage occurred in the fourth quarter of 1999, and is therefore only visible from 2000 onwards, with reference weeks then covering the second quarter of the calendar year. The same quarter was covered in **Sweden** starting from 2001. In the two years before that (starting with the year of the actual change to continuous reference weeks, 1999), reference weeks also cover a quarter, but an earlier one. The **Swiss** labor force survey covers the second quarter of the year up until 2009, and switches to the whole year in 2010. In the **UK**, the labor force survey covers a period of one quarter of the year already before the change in reference weeks takes place in 1992. The ELFS kept the same weeks until 2008, when it switches to continuous coverage also for the UK.

Table W.5 shows the deviations if only the weeks from the interim time period are used (i.e. mostly the second quarter) than when all weeks of the year are used as reference weeks for the raw measure of hours worked per employed in the first row, the employment rate in the second row, and our final measure of hours worked per employed in the third row, corresponding to Table 1 in Section 2. We use all available country-year pairs from 2005 to 2011, which are in total 106 observations (for 14 of our 18 European countries we can do the comparison in all years, for the UK only from 2008 to 2011, for Ireland 2009 to 2011, for Switzerland for 2010 and 2011; Germany is excluded because the switch was directly from one week to all weeks in 2005). The first row shows that the mean deviation of the raw measure of hours worked per employed is 2.8% if only the second quarter is sampled, compared to the entire year. At the 90th percentile, the deviation amounts to 5.4%, and the maximum deviation is 7.5% in France (2011). Thus, deviations are still substantial, but somewhat smaller than if only the initially sampled survey weeks are used. The second row confirms the low seasonality of the employment rate already documented if only the initially sampled weeks are used.

Finally, the third row confirms that our measure of annual hours worked per employed overcomes the problem of seasonality: the mean absolute percentage deviation is with 0.6% substan-

tially smaller than for the raw measure of hours worked per employed in the first row. The maximum percent deviation from sampling all weeks amounts to only 2% if the second quarter is sampled.

W.1.3 Calculation of Employment Rate

In this section, we provide two different alternative measures of the employment rate. The first alternative measure sets the employment status equal to one if an individual reports positive usual hours worked. This is reported in Table W.6. Using positive usual hours worked leaves the employment rate virtually unchanged. This is reassuring as anyone reporting to be employed should usually work positive hours.

Our next measure of the employment rate regards a knife edge case, namely how one handles parental leave policies, which are mostly relevant for women. The surveys give the option to report being employed while working zero hours in the reference week because of maternity leave. A brief leave immediately surrounding birth is certainly comparable to a sick leave in the context of the construction of our measures of labor supply. However, in countries with very generous maternity leave policies and long average maternity leaves,²⁵ it is less clear whether a mother on maternity leave should be counted as employed and contributing zero hours worked to hours worked per employed. Unfortunately, we do not observe how long a woman has already been on maternity leave or how long she intends to stay on leave. Therefore, in our baseline analysis we treat anyone who self-reports being employed but works zero hours because of maternity leave as being employed and contributing zero hours to our estimate of hours worked per employed (see the “baseline” columns in Table W.7). In an alternative approach, we treat all of these women as not being employed and thus not contributing to hours worked per employed (see the “Maternal leave = not employed” columns in Table W.7). This measure therefore provides a lower bound of the employment rate. As Table W.7 shows, these two different definitions only have a very modest impact on the female employment rates, with a maximum difference of 2.9 percentage points in Norway and a minimum difference of 0.2 percentage points in the US. These differences, while largest in country groups with generous maternal leave policies, namely Western Europe and Scandinavia, are hence too small to drive international differences in female employment rates.

²⁵E.g. German mothers may stay out of their job for up to three years and then in principle return to their previous employer at the same pay and position held prior to birth.

Table W.6: Alternative employment rate based on positive usual hours relative to self-reported employment rate (all years)

Country	Positive usual hours
Denmark	0.0
Norway	−1.0
Sweden	0.0
<i>Mean</i>	<i>-0.4</i>
Austria	0.0
Belgium	−0.1
France	0.0
Germany	−1.5
Ireland	0.0
Netherlands	−0.1
Switzerland	0.0
United Kingdom	0.0
<i>Mean</i>	<i>-0.2</i>
Czech Republic	−0.3
Hungary	0.0
Poland	−0.4
<i>Mean</i>	<i>-0.2</i>
Greece	0.0
Italy	0.0
Portugal	0.0
Spain	0.1
<i>Mean</i>	<i>0.0</i>
US	0.0

Table W.7: Female employment rate and hours worked per employed (all years): Different treatment of maternity leave

Country	ER			HWE		
	Baseline	Maternal leave = not employed	%p-difference	Baseline	Maternal leave = not employed	%-difference
Denmark	70.3	68.5	−1.9	1368.9	1405.6	2.7
Norway	72.4	69.6	−2.9	1258.8	1307.7	3.9
Sweden	70.3	67.0	−3.3	1388.1	1446.6	4.2
<i>Mean</i>	<i>71.0</i>	<i>68.3</i>	<i>-2.7</i>	<i>1338.6</i>	<i>1386.6</i>	<i>3.6</i>
Austria	61.9	59.9	−2.0	1432.6	1482.4	3.4
Belgium	46.4	45.9	−0.5	1488.4	1504.1	1.1
France	54.1	53.2	−0.9	1475.9	1500.6	1.7
Germany	58.1	57.1	−1.0	1363.4	1386.1	1.7
Ireland	45.5	44.7	−0.8	1491.2	1514.6	1.6
Netherlands	57.1	56.5	−0.6	1135.4	1144.1	0.8
Switzerland	70.0	69.5	−0.5	1350.3	1359.2	0.7
United Kingdom	61.3	60.5	−0.8	1348.9	1365.4	1.2
<i>Mean</i>	<i>56.8</i>	<i>55.9</i>	<i>-0.9</i>	<i>1385.8</i>	<i>1407.1</i>	<i>1.5</i>
Czech Republic	57.1	56.5	−0.6	1724.3	1743.5	1.1
Hungary	49.4	49.1	−0.2	1790.6	1799.5	0.5
Poland	49.8	49.4	−0.4	1740.7	1754.4	0.8
<i>Mean</i>	<i>52.1</i>	<i>51.7</i>	<i>-0.4</i>	<i>1751.9</i>	<i>1765.8</i>	<i>0.8</i>
Greece	40.7	40.5	−0.2	1769.0	1777.7	0.5
Italy	39.3	38.7	−0.6	1477.6	1495.9	1.3
Portugal	57.3	56.9	−0.4	1708.6	1720.3	0.7
Spain	38.8	38.5	−0.3	1606.0	1617.4	0.7
<i>Mean</i>	<i>44.0</i>	<i>43.7</i>	<i>-0.4</i>	<i>1640.3</i>	<i>1652.8</i>	<i>0.8</i>
US	64.0	63.8	−0.2	1713.3	1717.8	0.3

W.1.4 Differences in the Survey Questions on Hours Worked

The construction of our measure of hours worked requires knowing individual's actual hours worked as well as the reason why people worked less hours than usual. Actual hours worked are available for the main job and second job(s) in the ELFS, and for all jobs in the CPS. For individuals who are employed but did not work at all in the reference week, the CPS asks for the same information as the ELFS/Microcensus. For individuals who worked positive actual hours but less than usual, the ELFS/Microcensus asks for the reason why that is the case. However, in the CPS only employed respondents with positive actual hours and whose usual hours worked are at most 33 hours (up to 1993) or whose actual hours worked are at most 34 hours (from 1994 onwards) are asked for the reason why they worked less than 35 hours last week. Hence, for this set of employed respondents we can identify whether the respondent worked less than usual because of annual leave or public holiday. Up to 1993, for someone working usually more than 33 hours per week, but working less than usual (but positive hours) in the reference week, we cannot infer the reason. The same applies from 1994 onwards to someone who actually worked 35 hours or more, but still less than usual. Recomputing hours for the ELFS/Microcensus assuming that we would have exactly the same information set as in the CPS, we find that differences in the survey design up to 1993 would yield an on average -1.8% lower and at most 3.9% lower average hours per employed estimate for the European countries using the restricted information as in the CPS. These differences constitute however an upper bound (in absolute terms) for the years 1993 and before because many individuals with usual hours greater than 33 hours in fact also answered the question for the reason of having worked less than 35 hours. From 1994 onwards the differences in the survey design hardly affect our annual hours worked per employed measure: the difference between the average annual hours worked per employed based on the full and restricted information (as in the CPS) is at most 0.73% and on average 0.32%.

Capping of Hours In the ELFS, the largest possible value for usual or actual hours worked per week in the main job is 80, with the possibility of another maximum of 80 actual hours of work in additional jobs. In the CPS, the largest possible value for actual hours worked in all jobs is 99 hours per week. We harmonize the different capping procedures implemented by ELFS and CPS by introducing a common cap. To achieve maximum consistency across countries, we cap the possible number of actual and usual hours worked per week in all jobs at 80.

As Table W.8 shows, for the European countries the difference between capped and uncapped hours worked per employed only exceeds 0.1% in Denmark (0.16%) and Norway (0.11%). Only 0.07% of observations are affected on average. Capping US hours worked reduces annual hours per employed slightly more, with an average of 0.19%. As a caveat, the table only shows the effect of the *additional* capping that we implement; we cannot gauge the size of the effect of the initial capping implemented by the surveys, but it is likely to be very small. The fraction of observations at the highest allowed value for hours actually worked in the main job is 0.7% for the ELFS, 0.2% for the CPS, and 0.03% for the Microcensus.

Table W.8: The Effect of Capping on Hours Worked per Employed (all years, in %)

Country	H^E without capping	H^E with capping	Difference in %
Denmark	1559.11	1556.72	−0.16
Norway	1475.85	1474.25	−0.11
Sweden	1565.86	1565.03	−0.05
<i>Mean</i>	<i>1533.61</i>	<i>1532.00</i>	<i>-0.11</i>
Austria	1683.42	1682.12	−0.08
Belgium	1703.42	1702.89	−0.03
France	1652.39	1651.84	−0.03
Germany	1610.16	1609.31	−0.05
Ireland	1798.28	1797.48	−0.05
Netherlands	1485.24	1484.98	−0.02
Switzerland	1693.32	1692.29	−0.06
United Kingdom	1672.55	1672.12	−0.03
<i>Mean</i>	<i>1662.35</i>	<i>1661.63</i>	<i>-0.04</i>
Czech Republic	1865.28	1864.93	−0.02
Hungary	1873.75	1873.38	−0.02
Poland	1892.50	1891.27	−0.06
<i>Mean</i>	<i>1877.18</i>	<i>1876.53</i>	<i>-0.03</i>
Greece	1922.41	1921.19	−0.06
Italy	1665.28	1665.21	0.00
Portugal	1827.16	1826.13	−0.06
Spain	1757.48	1757.38	−0.01
<i>Mean</i>	<i>1793.08</i>	<i>1792.48</i>	<i>-0.03</i>
US	1880.23	1876.64	−0.19

W.2 Public Holidays and Days of Annual Leave

W.2.1 External Data for Public Holidays and Days of Annual Leave

For some countries (Denmark, France, Germany, Netherlands, Switzerland, United Kingdom, United States), we obtain statistics on average numbers of public holidays and days of annual leave covering the entire sample period from the national statistical offices and other public institutions detailed below. For the remaining countries, average days of annual leave and public holidays are obtained from the European Industrial Relations Observatory (EIRO), which provides data on days of annual leave and public holidays for the years 2002 to 2011. For the years prior to 2002, we use two different strategies. For some countries (Austria, Belgium, Portugal, and Sweden), we were able to obtain from the International Labor Organization ILO the number of days of national bank holidays (subtracting those falling on a Sunday) as well as the number of days of annual leave, both as indicated by national laws (i.e. ILO refers to labor laws rather than actual collected statistics as sources of these numbers). For the remaining countries (Czech Republic, Greece, Hungary, Ireland, Italy, Norway, Poland, and Spain), we use the EIRO mean over the years 2002 to 2011 to extend the series backwards. The Web Appendix [W.2](#) contains detailed graphs displaying the time-series of public holidays and annual leave days for all countries, in addition to a comparison to the EIRO data for the group of countries for which we have data from both national statistical offices and EIRO. Table [W.9](#) shows the average number of public holidays and days of annual leave for each country in the first three survey years and the last three survey years.

Table W.9: Average Number of Public Holidays and Days of Annual Leave over First 3 and Last 3 Survey Years

Country	Public holidays		Annual leave		Public holidays + Annual leave	
	Start	End	Start	End	Start	End
Germany	11.5	8.5	30.7	30.7	42.2	39.2
Italy	12.0	10.3	28.0	28.0	40.0	38.3
France	8.3	9.7	29.5	29.5	37.9	39.2
Austria	12.0	11.0	25.0	25.0	37.0	36.0
Sweden	10.3	9.7	25.0	25.0	35.3	34.7
Spain	13.1	14.0	22.0	22.0	35.1	36.0
Czech Republic	9.5	10.3	25.0	25.0	34.5	35.3
Norway	9.1	9.0	25.0	25.0	34.1	34.0
Greece	11.0	10.0	23.0	23.0	34.0	33.0
Portugal	10.7	11.7	22.0	22.0	32.7	33.7
Belgium	8.3	10.0	24.0	20.0	32.3	30.0
Switzerland	8.0	8.0	23.2	24.8	31.2	32.8
United Kingdom	8.1	8.5	21.5	23.3	29.6	31.7
Denmark	9.5	9.7	20.0	30.0	29.5	39.7
Netherlands	6.7	6.3	22.8	21.0	29.5	27.3
Poland	9.4	9.0	20.0	20.0	29.4	29.0
Ireland	9.0	8.3	20.0	24.0	29.0	32.3
Hungary	8.9	8.0	20.0	20.0	28.9	28.0
US	9.8	7.2	10.7	11.1	20.5	18.3

W.2.2 Vacation in Micro Data vs. External Data

Table W.10: Annual Weeks Lost due to Public Holidays and Annual Leave (2005-2011)

Country	Weeks lost to public holidays and vacation		Fraction of sample on leave
	self-reported	external data	
Denmark	5.0	7.4	14.9
Norway	4.6	6.8	13.3
Sweden	5.1	6.9	17.9
<i>Mean</i>	<i>4.9</i>	<i>7.0</i>	<i>15.4</i>
Austria	3.8	7.3	15.4
Belgium	4.1	5.9	14.1
France	5.6	8.0	16.1
Germany	2.9	8.1	8.3
Ireland	1.9	6.2	11.4
Netherlands	4.8	5.5	14.7
Switzerland	4.0	6.5	11.1
United Kingdom	3.5	6.5	13.5
<i>Mean</i>	<i>3.8</i>	<i>6.7</i>	<i>13.1</i>
Czech Republic	2.6	6.9	12.3
Hungary	1.4	5.7	6.9
Poland	1.2	5.9	8.1
<i>Mean</i>	<i>1.7</i>	<i>6.2</i>	<i>9.1</i>
Greece	1.5	6.6	10.9
Italy	2.9	7.7	10.1
Portugal	2.2	7.1	13.8
Spain	3.2	7.1	13.0
<i>Mean</i>	<i>2.4</i>	<i>7.1</i>	<i>11.9</i>
US	1.4	3.5	4.6

The first two columns of Table W.10 compare the number of weeks lost due to vacation/public holidays based on self-reports in the micro data to weeks lost due to vacation and public holidays from our external data sources for the years 2005 to 2011. For the self-reports, we assign for each individual who has worked at least as much as usual in the main job or less because of another reason than public holidays or annual leave a zero. For those having worked less than usual because of public holidays or annual leave, we divide the difference between usual and actual hours by usual hours. The latter measures the fraction of the usual work week lost to accommodate part-time workers' smaller usual hours in a usual work week. We multiply this number by 52 weeks to get an annualized value and then take the mean across all employed individuals. This yields the average number of weeks lost because of annual leave and public holidays. On average the

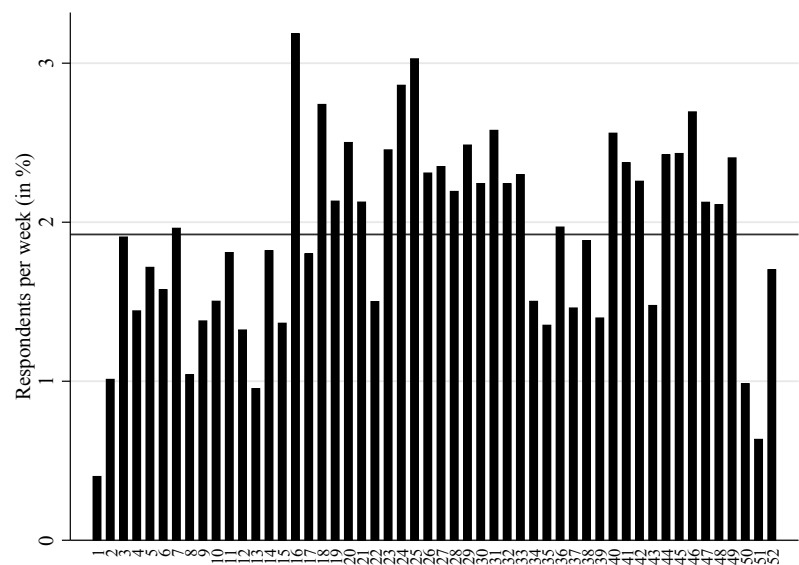
self-reported vacation amount to 3.3 weeks in Europe whereas the external data suggest a number of 6.8 weeks. In 5 of the 19 countries, self-reported public holidays and annual leave days amount to less than 2 weeks. Overall, given that public holidays alone in many countries sum up to 1.5 weeks, the self-reported number of the sum of days of annual leave and public holidays seems too small.

Analyzing the Microcensus data further, there could be several reasons for underreporting of vacation days. The German Statistical Office (Destatis) analyzed the issue of the distribution of reference weeks.²⁶ First, the Microcensus always takes the week before the interview as reference week (i.e. it does not give fixed dates for the reference week, but refers in questions to the previous week, whenever the interview is carried out). The interview is generally carried out personally, and if a household is not encountered by the interviewer in the intended week, the interviewer comes back to the household later on. Therefore, the de facto distribution of reference weeks over the year is not uniform, but more importantly the sample of respondents in a given week is not representative. Specifically, it could be that due to this procedure, households that were on vacation the week before are missed more frequently than others and are in fact interviewed later when they have been back from vacation for some time. Figure W.1 shows for the year 2006 for Germany the quite uneven distribution of reference weeks.

Second, respondents might dislike using a vacation week as a reference week, either because they are too busy the first week after a vacation to fill out the questionnaire, or because they perceive it as “inappropriate” to use a vacation week when in fact they are generally hard working. One indication that goes into this direction is that people who decline to be interviewed in person but fill out the survey by paper and pencil later by themselves are less likely to indicate days of annual leave. Regarding public holidays, the number of full-time employees reporting having worked less hours than usual due to public holidays is not exceeding 30% in weeks with nationwide bank holidays in 2010 which is clearly too low. However, due to the much lower number of public holidays than days of annual leave this underrepresentation is of less importance than the underrepresentation of days of annual leave.

²⁶The following information comes from Thomas Körner at Destatis.

Figure W.1: Distribution of Reference Weeks for Germany in the ELFS in 2006



W.2.3 Source of Country-Specific Information on Public Holidays and Annual Leave

Country	Public Holidays	Annual Leave
Denmark	<ul style="list-style-type: none"> 1983-2008: From the Confederation of Danish Employers (DA) we obtain data on three variables: Agreed weekly hours ($h_{ag,DA}$), agreed annual hours ($H_{ag,DA}^E$, net of days of annual leave and public holidays) and the number of days of annual leave (daleave). Assuming that a regular working week comprises 5 working days, the number of public holidays (dpublic) can be calculated as follows: $d_{public} = \frac{h_{ag,DA} * (52 - daleave/5) - H_{ag,DA}^E}{h_{ag,DA}/5}$ The term in the numerator calculates the number of annual hours lost due to public holidays (agreed weekly hours $h_{ag,DA}$ times the number of non-vacation weeks minus the number of agreed annual hours $H_{ag,DA}^E$), the term in the denominator calculates average daily hours. Dividing one by the other yields the number of days lost due to public holidays. The Agreed Annual Hours $H_{ag,DA}^E$ are only available every five years. In order to obtain the number of holidays in the years without $H_{ag,DA}^E$ we fit a 8th-order polynomial through the years where we have observations. Note that we exclude the year 1985 from this exercise but rather interpolate it as well because of the exceptional high value (14 public holidays as opposed to on average 7.5 days) for which we don't have a plausible explanation. Since the non-interpolated holidays are always integers (with exception of the first two observations 1960 and 1965), we use the respective integer value of the interpolated series. The resulting numbers of public holidays are lower than the EIRO levels and exhibit less variation. 2009-2011: The interpolation employed in the previous years predicts a sharp increase in public holidays, exceeding even the EIRO numbers, so that we instead use those for these years. 	<ul style="list-style-type: none"> 1983-2008: Directly given by the Confederation of Danish Employers (DA)
France	<ul style="list-style-type: none"> 2002-2011: EIRO. 1983-2000: "Direction de l'animation de la recherche, des études et des statistiques" (DARES), published in the study "Comparaisons internationales de durée et de productivité" by Chagny & Bruyère (2002). 	<ul style="list-style-type: none"> 1983-2011: "Direction de l'animation de la recherche, des études et des statistiques" (DARES), published in the study "Comparaisons internationales de durée et de productivité" by Chagny & Bruyère (2002). We use the value from 1999 to fill in the missing values for the years 2000-2008.

Germany

- The Institute for Employment Research (Institut für Arbeitsmarkt- und Berufsforschung, IAB) provides data on the average number of public holidays in its “Arbeitszeitrechnung”.

- The IAB also provides data on the average number of days of annual leave (agreed regular days of annual leave plus additional leave) in its “Arbeitszeitrechnung”.

Netherlands

- 1983-2008: Central Planning Bureau (CPB) provides numbers of public holidays without Saturdays and Sundays.

- 1980-1992: Statistics Netherlands (CBS) provides numbers for vacation days including public holidays, from which we subtract the number of public holidays from the CPB.
- 1995-2005: Numbers are taken directly from the “Enquete werkgelegenheid en lonen” (EWL) provided by the CBS.

Switzerland

- 1997-2011: The number of public holidays varies strongly between the 26 cantons. The minimum number of public holidays in every canton is 8, which is what we adopt as the number of public holidays.

- The Swiss Statistical Office provides number on Swiss employees’ average number of weeks of annual leave. Multiplying this number by 5 days per week yields the number of days of annual leave between 1996 and 2011.

United Kingdom

- 1983-2008: The UK government’s digital service (<http://www.direct.gov.uk/>) provides the number of public holidays in England, Wales, Scotland and Northern Ireland. These are weighted by the employment shares (obtained from the Office of National Statistics) to calculate the average number of public holidays in the UK. Numbers are available from 1993 onwards, previous years are imputed using the mean.

- 1983-2008: UK Labor Force Survey asks employees about their entitlement to paid holidays. These numbers are used to calculate the average number of days of annual leave for full-time employees.
-

United
States

- 1979-1998: Employee Benefit Survey (EBS), conducted by the Bureau of Labor Statistics (BLS).
 - 1999-2008: National Compensation Survey (NCS), also conducted by the BLS.
 - Average number of holidays is based on the product of two data series: the fraction of workers with paid holidays and the average number of public holidays of those with paid holidays.
 - Also based on EBS (1979-1998) and NCS (1999-2008), which provide time series on the fraction of all workers with days of paid annual leave and on the average number of days of paid annual leave for those with paid annual leave. The latter is only available by firm-specific tenure intervals, so we have to combine this data with data on the firm-specific tenure distribution, obtained from the BLS (but based on the CPS), to calculate the average number of days of annual leave.
 - The data refers to private firms and full-time employees only.
 - Mostly, there is perfect overlap between EBS/NCS leave data and BLS/CPS tenure data. Exceptions: (1) From 1980-1996, the EBS/NCS data distinguishes between tenure of 25-29 years, and 30+ years, while the BLS/CPS data only has a category 25+. We use the average of the two EBS/NCS groups to align the two data sets. (2) From 1980-1991, the BLS/CPS data only provides worker shares for 7-23 months of tenure, while the EBS/NCS data provides the average leave data for 7-12 months of tenure. We impute the share of workers with 7-12 months tenure using the relative shares of workers with 7-12 months and 1-2 years from the BLS/CPS data in 1996. (3) After 1989, there is no information on paid annual leave for workers with less than 1 year tenure. We assume that these workers have as many days of annual leave as they had in 1984.
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W.2.4 Public Holidays and Annual Leave by Country

Figure W.2: Austria

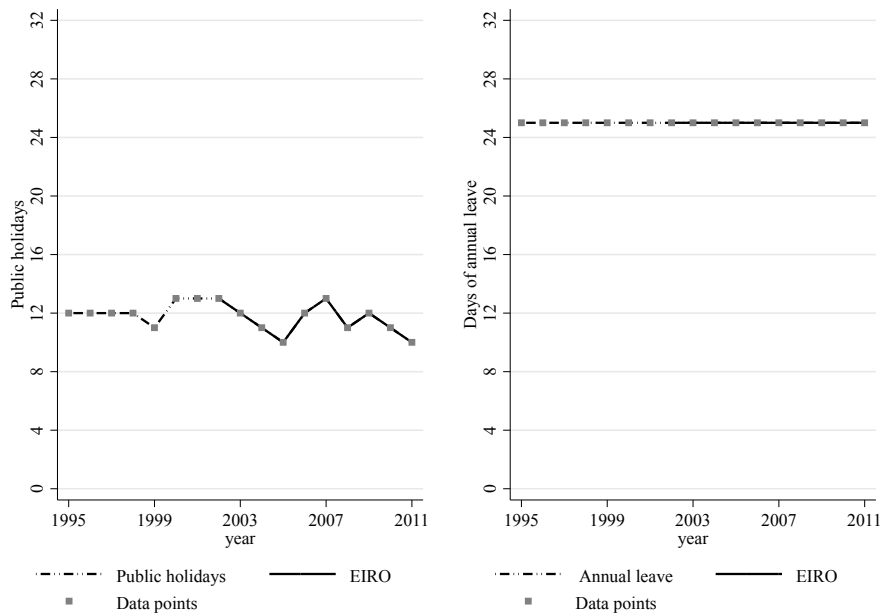


Figure W.3: Belgium

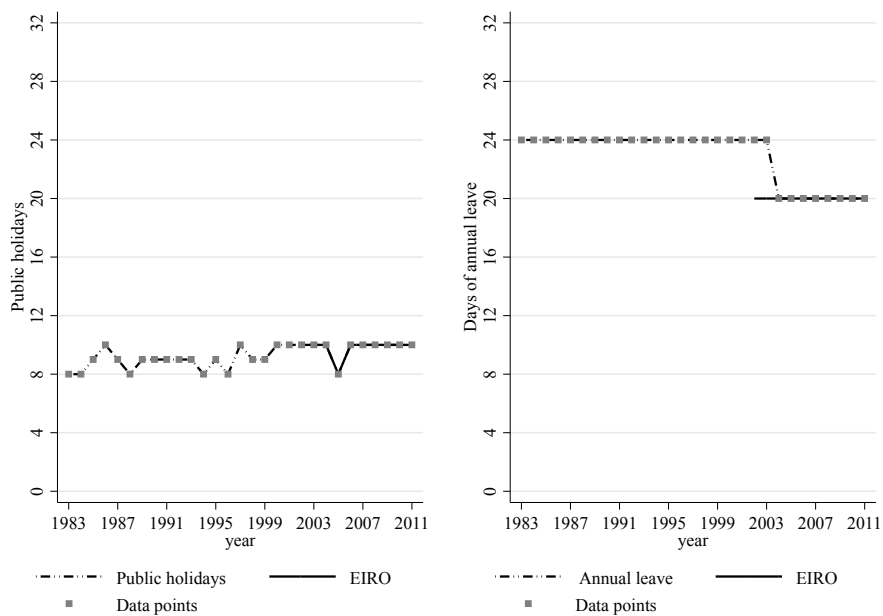


Figure W.4: Czech Republic

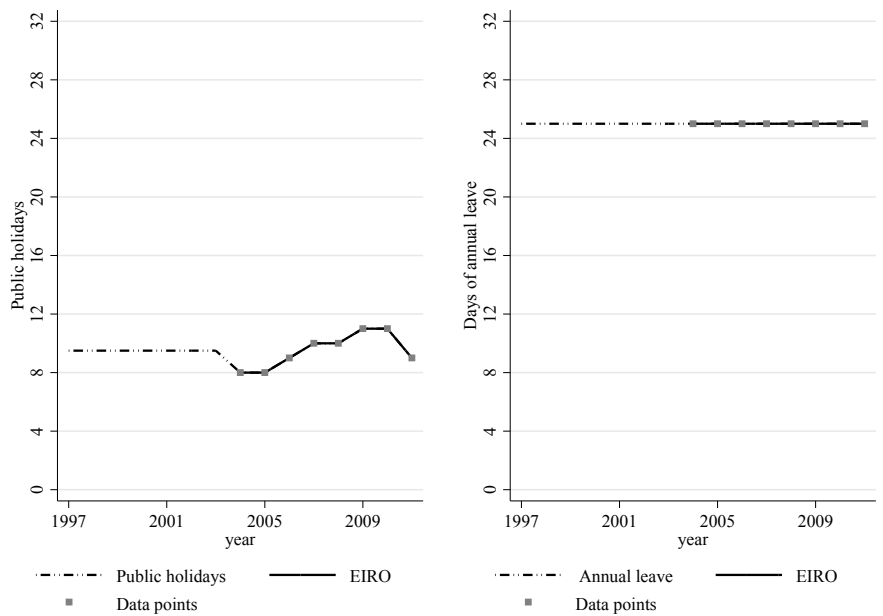


Figure W.5: Denmark

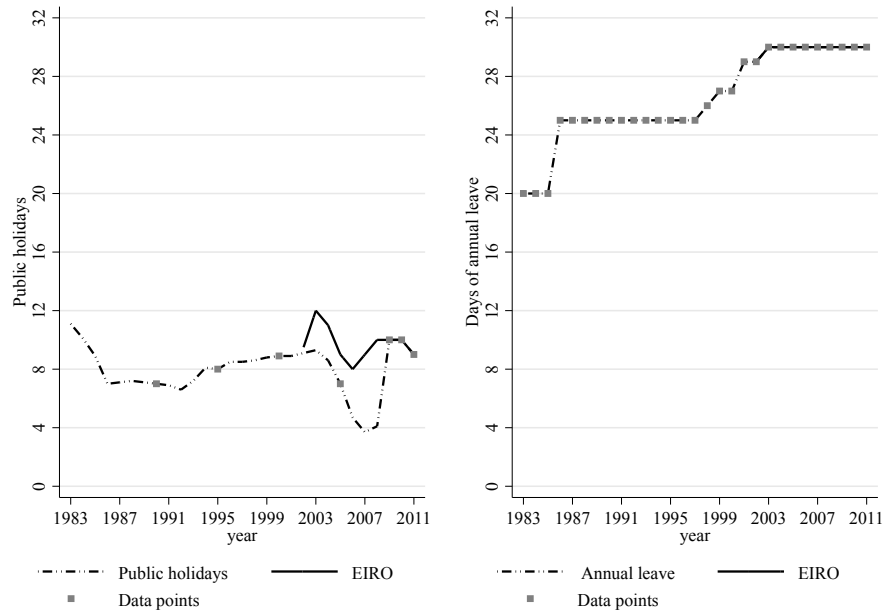


Figure W.6: France

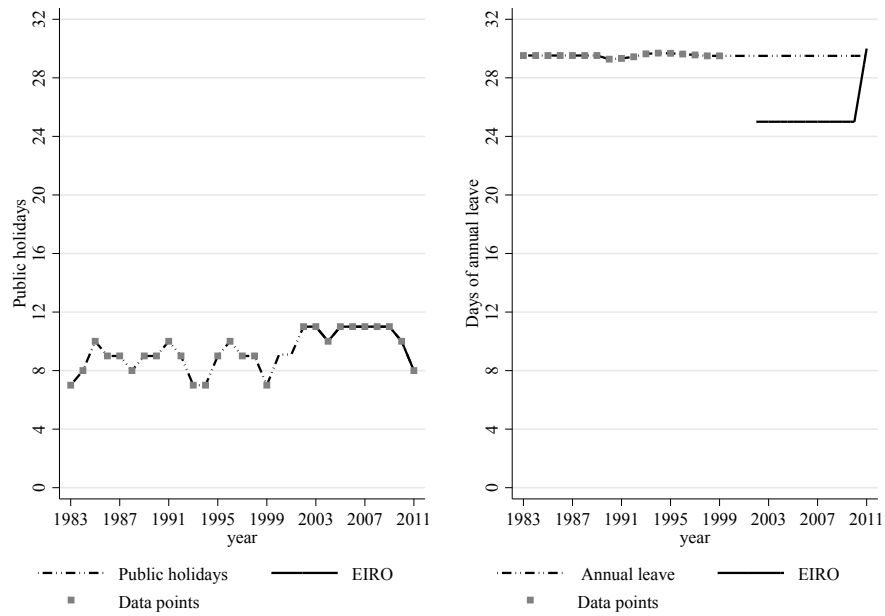


Figure W.7: Germany

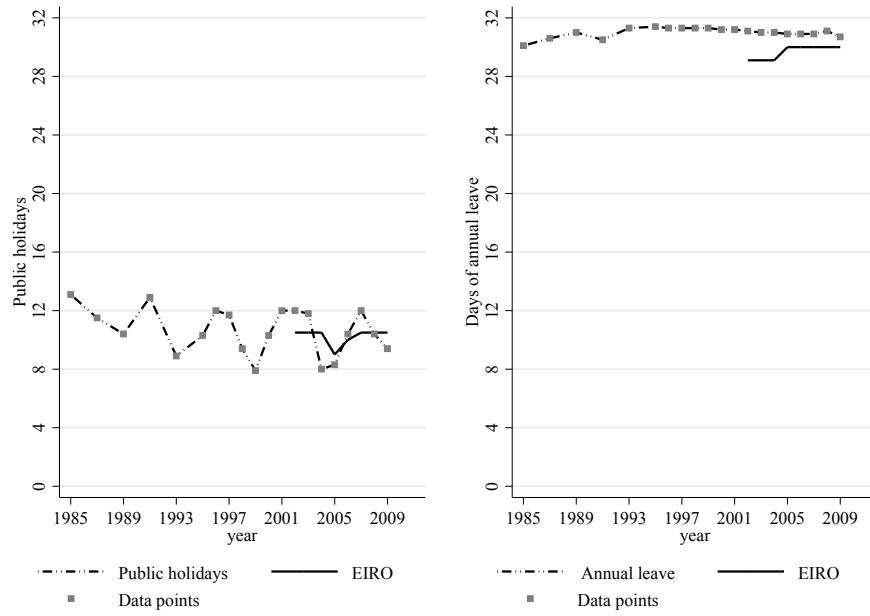


Figure W.8: Greece

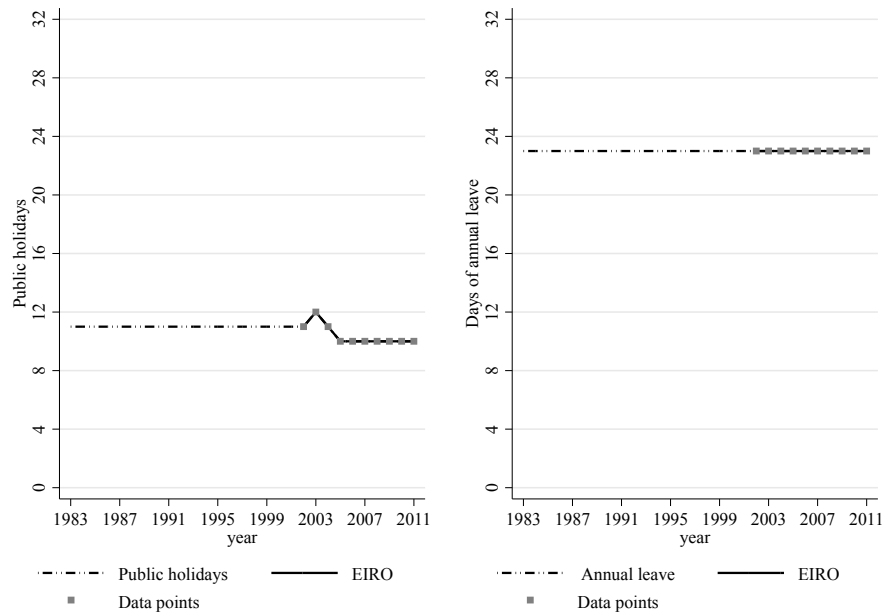


Figure W.9: Hungary

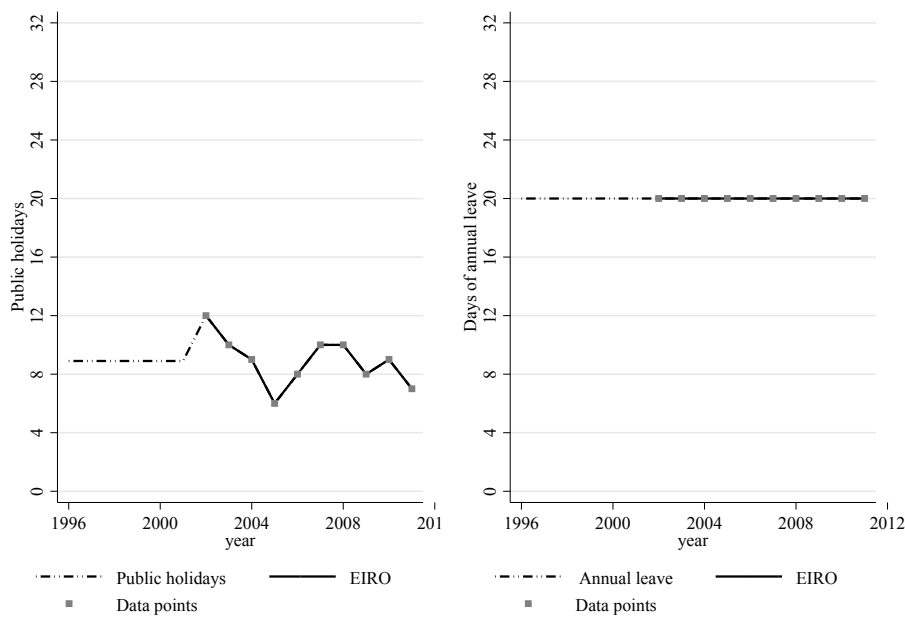


Figure W.10: Ireland

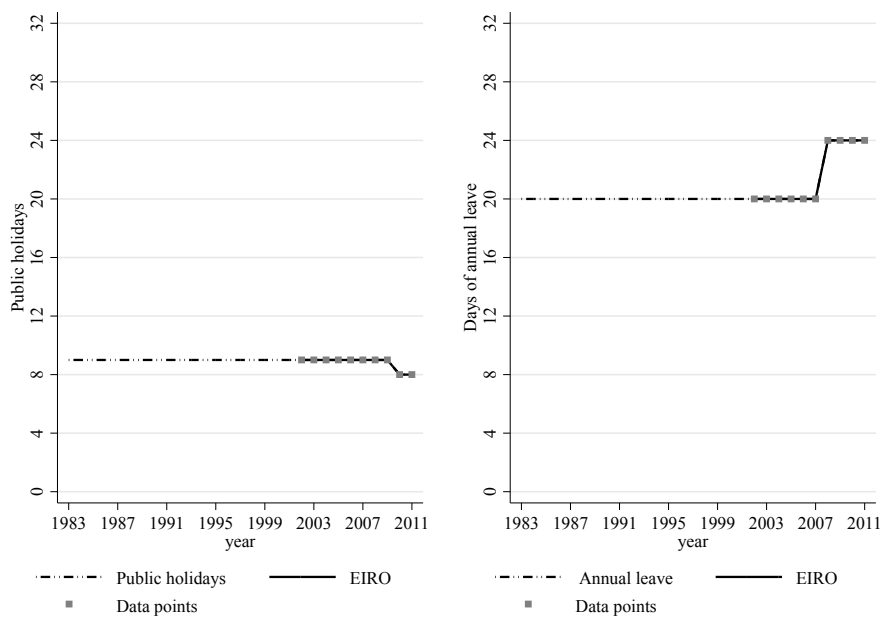


Figure W.11: Italy

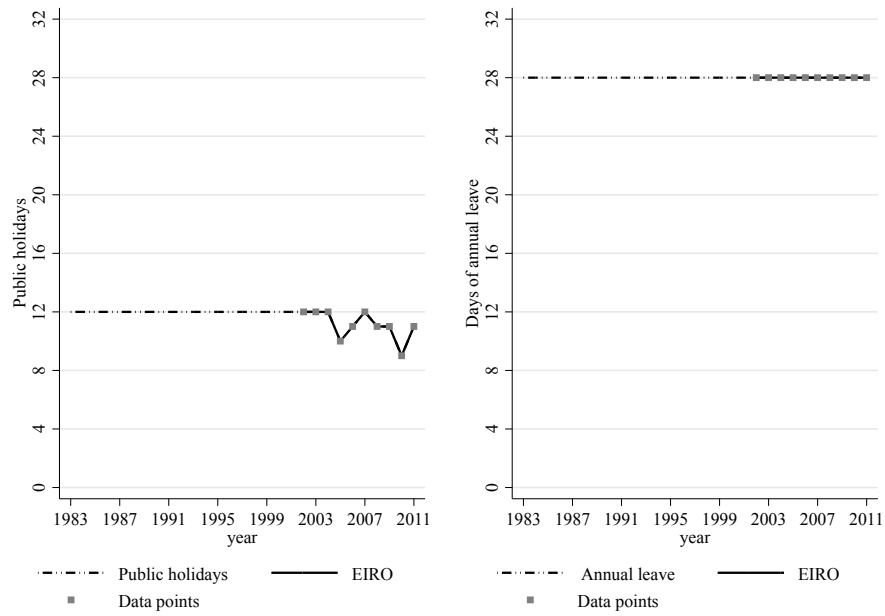


Figure W.12: Netherlands

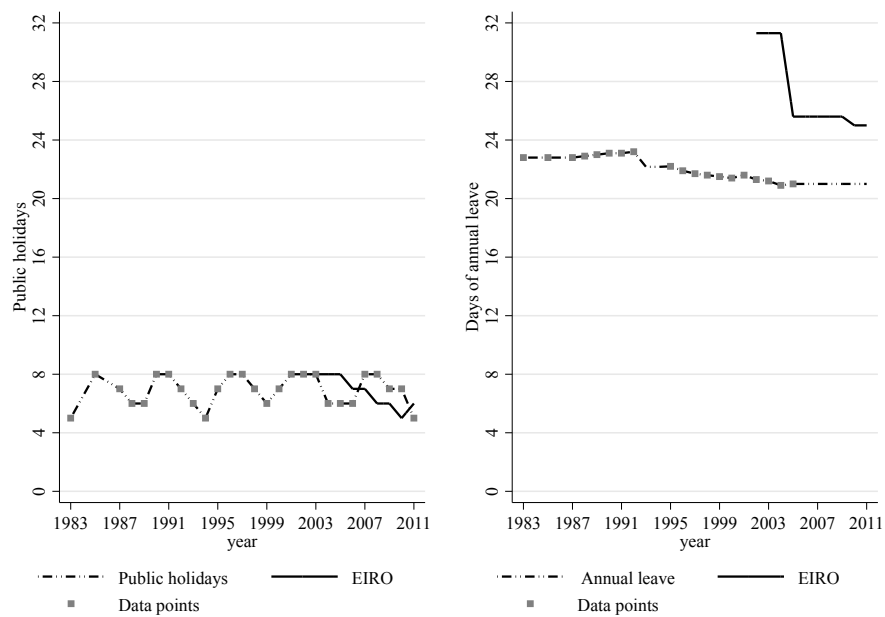


Figure W.13: Norway

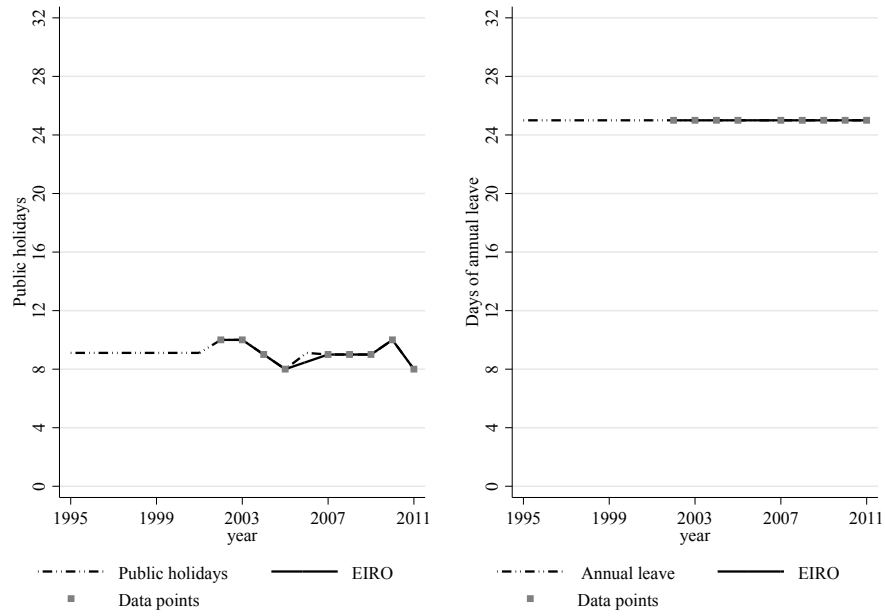


Figure W.14: Poland

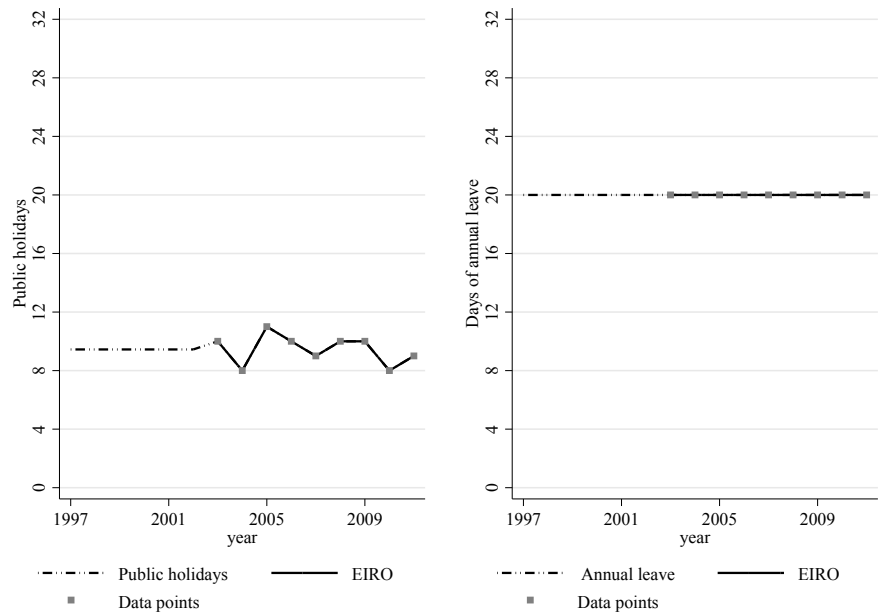


Figure W.15: Portugal

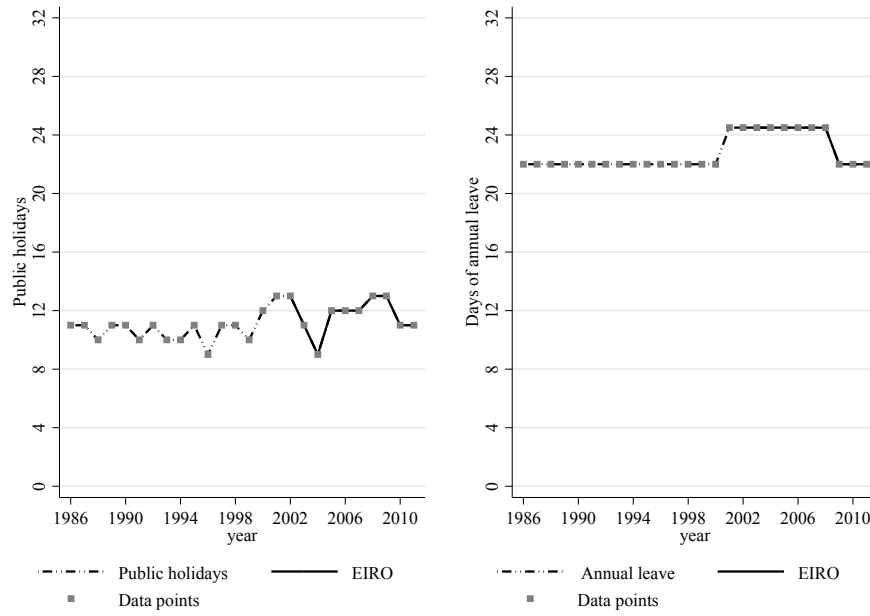


Figure W.16: Spain

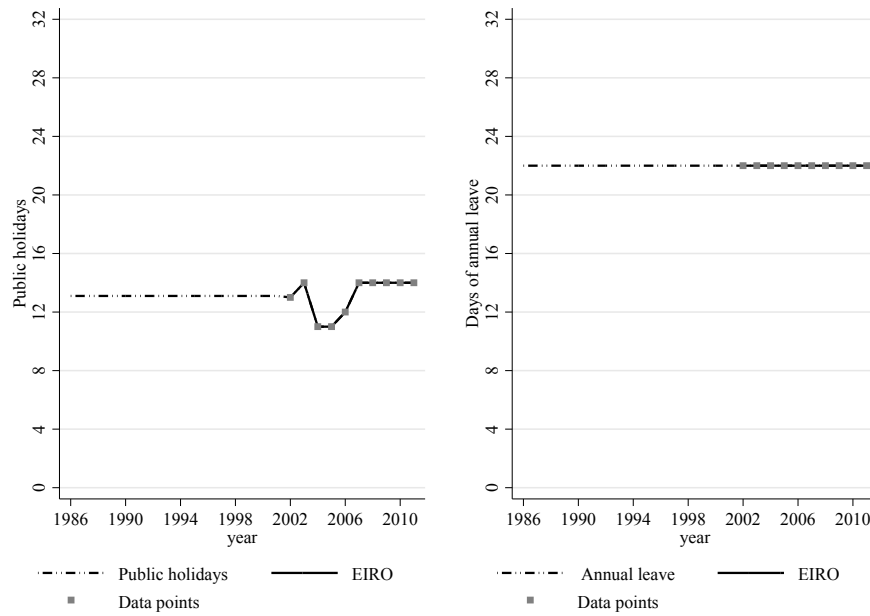


Figure W.17: Sweden

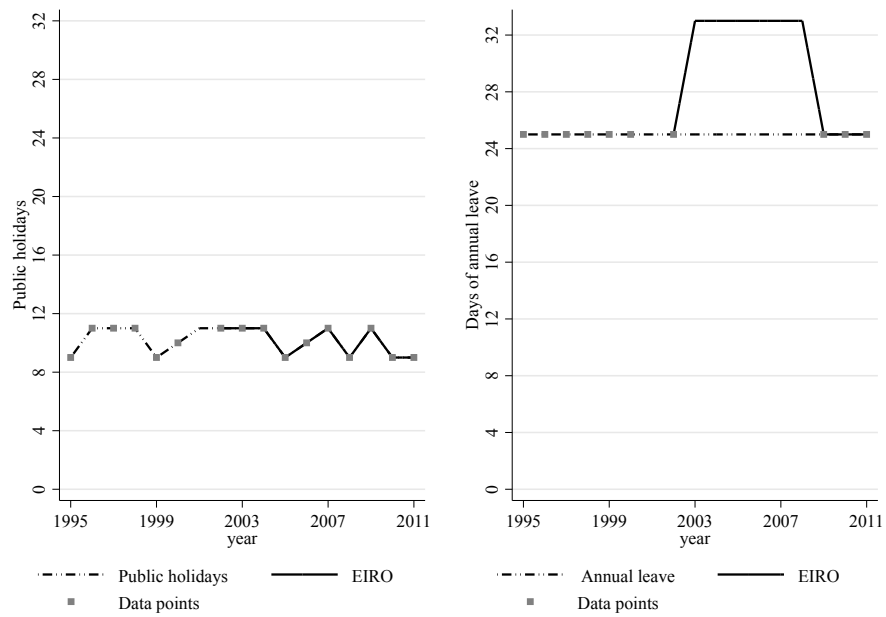


Figure W.18: Switzerland

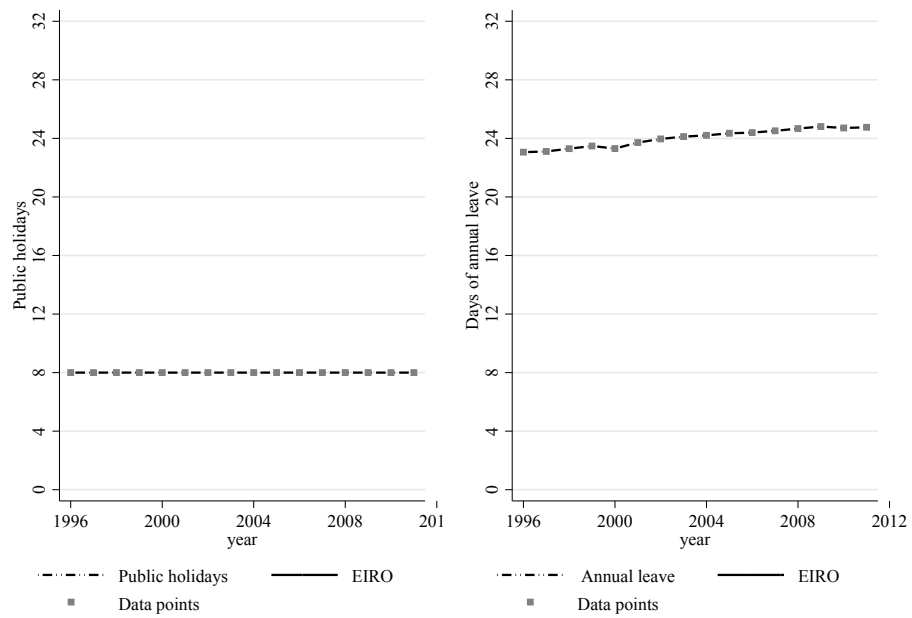


Figure W.19: United Kingdom

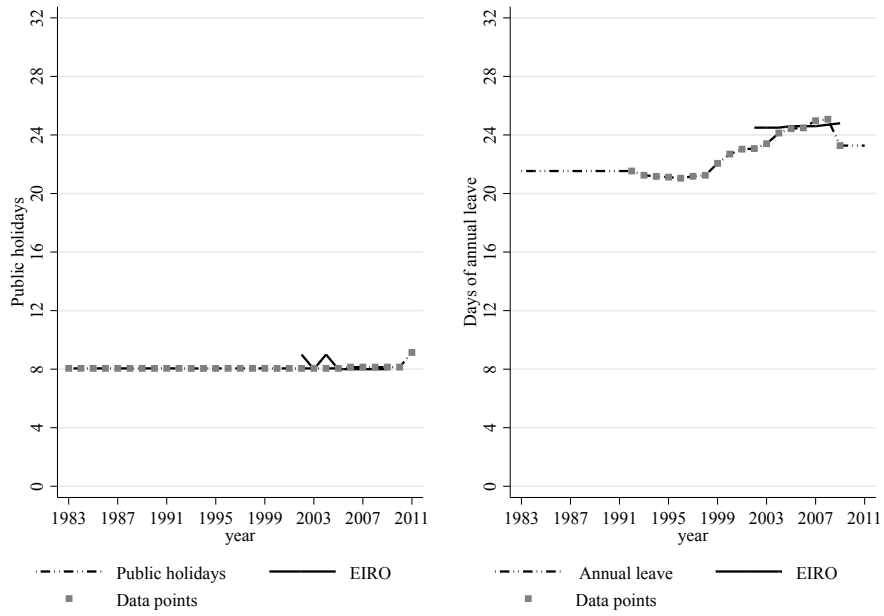
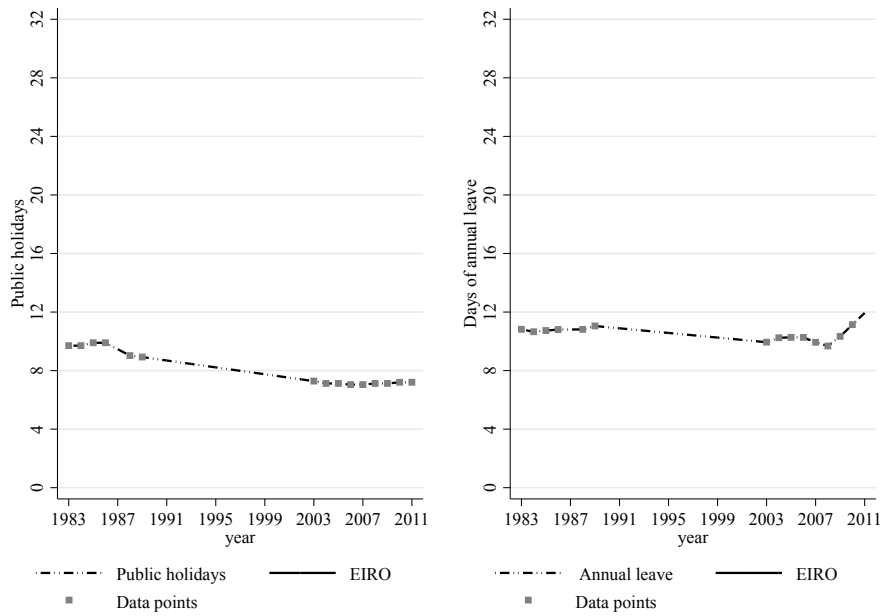


Figure W.20: United States



W.2.5 Heterogeneity in Public Holidays and Annual Leave

In the benchmark analysis, we assume that the number of vacation days are the same for each individual. However, in the micro data, we can estimate the number of vacation days for different groups. Define \bar{v} as the average vacation weeks in the external data for a given country and year. In the labor force surveys, we can estimate $\hat{v} = \sum_j \frac{N_j^e}{N^e} v_j$ as the average vacation weeks, with N^e being the number of all employed individuals in the micro data, N_j^e the number of all employed individuals in group j , $\frac{N_j^e}{N^e}$ the employment share of group j , and v_j the average vacation weeks for group j from the micro data. Since we document substantial underreporting of vacation days in the labor force surveys, we impose consistency between the external vacation weeks and vacation weeks in the micro data by scaling vacation weeks of all groups up proportionally with a scaling factor x :

$$\bar{v} = (1 + x)\hat{v} \Leftrightarrow 1 + x = \frac{\bar{v}}{\hat{v}}$$

Our robustness measure of hours worked that allows for heterogeneity in the number of vacation days taken by different groups then amounts to

$$\hat{H} = \sum_j f_j e_j \sum_k [52 - v_{j,k}(1 + x)] s_{j,k} h_{j,k} = \sum_j f_j e_j \sum_k [52 - \bar{v} \times \frac{v_{j,k}}{\hat{v}}] s_{j,k} h_{j,k}$$

This measure is different from the baseline measure if there is heterogeneity in the number of vacation days for different subgroups. We calculate this measure relying on the same subgroups used in Section 5.2, namely subgroups built on gender, three age groups (15-24, 25-54, 55-64), three education groups (low, medium, high), and the three sectors services, manufacturing, and agriculture.

Table W.12 compares our baseline measure of hours worked per person built on assuming homogeneous vacation weeks within a country with the alternative measure allowing for within-country-year variation of vacation weeks by demographic group. Differences between both measures are negligible, with a maximum difference of 8.9 annual hours for Denmark. Note that by scaling up vacation weeks by a common multiplicative factor, rather than a common additive factor, and by allowing for variation in vacation weeks, and not weeks worked, we bias our alternative measure towards finding the largest possible differences to the measure relying on homogeneous weeks. We can therefore confidently conclude that assuming homogeneous vacation weeks rather than allowing variation of vacation weeks for different demographic groups has no effect on the measure of aggregate hours worked per person.

Table W.12: *H* with heterogeneous vacation weeks

Country	Constant Weeks	Heterogeneous Weeks	%-difference
Denmark	1174.1	1183.0	0.8
Norway	1116.2	1114.8	−0.1
Sweden	1141.8	1139.9	−0.2
<i>Mean</i>	<i>1144.0</i>	<i>1145.9</i>	<i>0.2</i>
Austria	1181.0	1183.0	0.2
Belgium	1013.3	1013.6	0.0
France	1007.0	1007.9	0.1
Germany	1052.4	1051.5	−0.1
Ireland	1155.8	1160.2	0.4
Netherlands	1078.2	1076.7	−0.1
Switzerland	1306.4	1313.0	0.5
United Kingdom	1146.1	1148.3	0.2
<i>Mean</i>	<i>1117.5</i>	<i>1119.3</i>	<i>0.1</i>
Czech Republic	1218.7	1219.7	0.1
Hungary	1066.0	1067.2	0.1
Poland	1029.2	1032.6	0.3
<i>Mean</i>	<i>1104.6</i>	<i>1106.5</i>	<i>0.2</i>
Greece	1158.4	1166.0	0.7
Italy	960.1	962.8	0.3
Portugal	1184.8	1185.1	0.0
Spain	1103.0	1103.9	0.1
<i>Mean</i>	<i>1101.6</i>	<i>1104.5</i>	<i>0.3</i>
US	1360.5	1360.0	0.0

W.3 Reasons for Working More or Less than Usual

Table W.13 displays the average hours lost for our 113 available country-year pairs from 2005 to 2011 under the initially sampled reference weeks in the first row and all reference weeks in the second row. Annual leave constitutes the most important reason for working less hours than usual, followed by a composite of other reasons (bad weather, slack work for technical or economic reasons, labor dispute, education or training, compensation leave, and further reasons like family responsibilities). The only two categories for working more or less than usual that vary with the set of reference weeks are annual leave and public holidays, being 1.2 hours more for annual leave and 0.1 hours less for public holidays when all weeks of the year are used. From this we conclude that an adjustment for the remaining categories seems to be unnecessary in order to achieve consistency over time. Regarding the question of systematic over- or underreporting of other categories of hours lost in the labor force surveys, we collect some suggestive evidence for sick days for a subset of countries and years. Comparing sick days from external data sources to the reported sick days in our data, we find that the self-reported number of sick days are smaller than sick days from external data sources, a similar finding as the one for vacation days, but the discrepancy is on average smaller than for vacation days and public holidays (see Table W.14). It amounts on average to 1.2 weeks in Scandinavia, 2.7 weeks in Eastern Europe, 0.9 weeks in Western Europe, 0.5 weeks in Southern Europe, and 0.3 weeks in the US. Also similar to vacation days, the discrepancy is lower in the US than on average in Europe, and thus correcting for sick days from external data sources would make the observed Europe-US hours difference that we document later larger.

Table W.13: Reasons for Working More or Less than Usual – Mean Weekly Hours

Period	Weekly hours lost due to					Extra hours due to Add. Jobs+Overtime
	Annual L.	Pub. Holidays	Sick L.	Maternity L.	Other	
Initial Weeks	1.20	0.58	0.78	0.31	0.95	2.05
All Weeks	2.41	0.47	0.77	0.32	0.99	1.96

Table W.14: Annual Weeks Lost due to Sickness for Years with External Data on Sick Leave

Country	Weeks lost due to illness		Available Years
	self-reported	external data	
Denmark	1.1	1.8	1984-2011
Norway	2.2	3.6	2001-2008
Sweden	2.1	4.1	1995-2006
<i>Mean</i>	<i>1.8</i>	<i>3.1</i>	
Austria	1.1	2.4	1995-2008
Belgium	1.0	1.9	2006-2008
France	1.3	1.6	1983-2011
Germany	0.9	3.2	1985-2011
Ireland	0.7	–	-
Netherlands	2.1	2.8	1983-2011
Switzerland	0.9	2.2	1997-2007
United Kingdom	1.3	1.5	1983-2011
<i>Mean</i>	<i>1.1</i>	<i>2.2</i>	
Czech Republic	1.3	4.5	1997-2008
Hungary	0.6	2.9	1996-2008
Poland	0.5	–	-
<i>Mean</i>	<i>0.8</i>	<i>3.7</i>	
Greece	0.2	0.7	1998-2006
Italy	0.6	–	-
Portugal	1.0	1.3	1986-2011
Spain	1.0	1.8	1986-2011
<i>Mean</i>	<i>0.7</i>	<i>1.2</i>	
US	0.7	1.0	1983-2011

Note: External data on sick days are obtained from the OECD for all countries except Germany, where the data is obtained from the German Statistical Yearbook 2010.

W.4 Data from OECD and Total Economy Database (TED)

W.4.1 Hours Data Sources for OECD

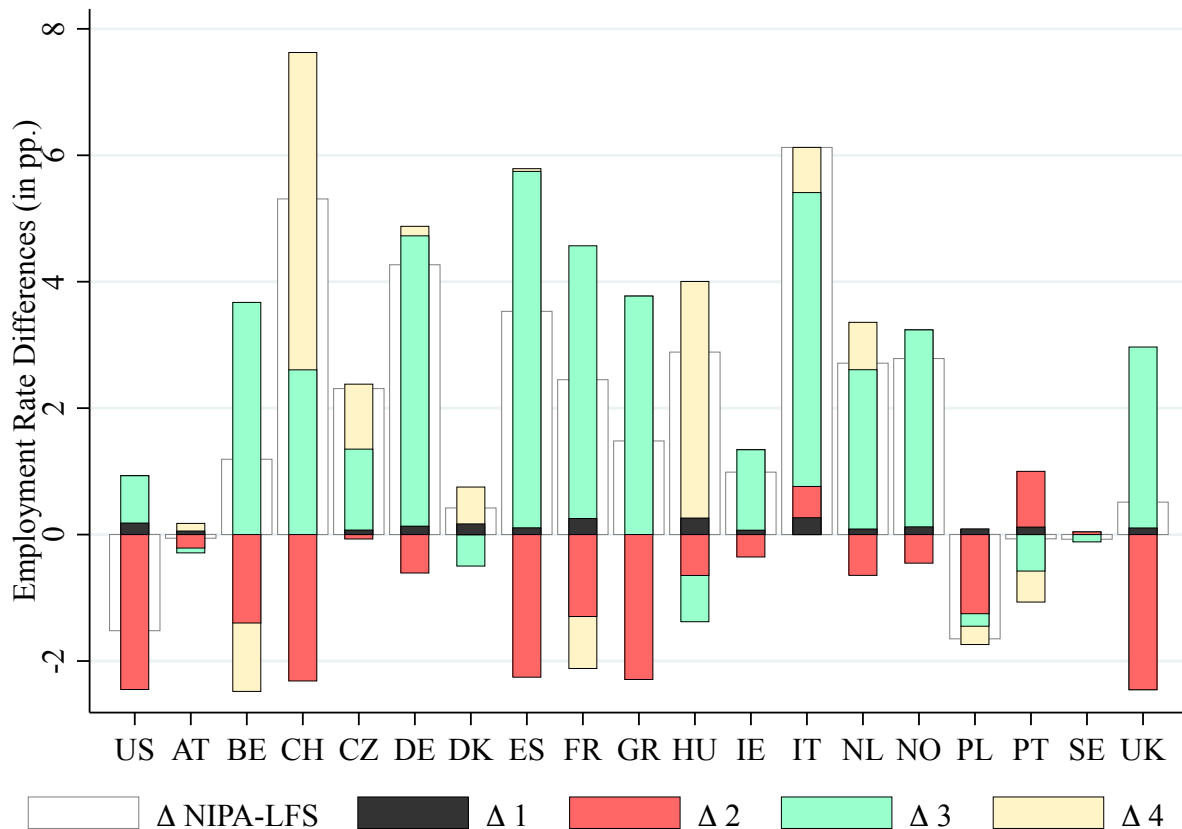
Country	Employment	Hours
Austria	Employment is calculated based on several sources, e.g. social insurance statistics, the Structural Business Survey (SBS), the non-agricultural business survey, the Microcensus, and the Labor Force Survey. Since 2004 calculations have been mainly based on the LFS.	For total hours, working hours per job are calculated based on the short-term production survey and the Microcensus and are then multiplied by employment. Since 2004 calculations have been mainly based on the LFS.
Belgium	Administrative sources (social security institutions) are mainly used to calculate employment. Surveys (e.g. the Labor Force Survey) serve as secondary sources.	The main sources are administrative data from social security institutions. The data are adjusted for holidays and sick leave, but not for other absences or overtime (status quo in 2006). Self-employed are not included.
Czech Republic	Business statistics are used in combination with administrative data to calculate employment.	Average hours are calculated based on average weekly hours worked in the labor force survey, excluding hours lost due to sickness and annual leave, and then multiplied by employment.
Denmark	Statistics Denmark produces a “Working Time Account” (WTA), which serves as basis for the National Accounts. The WTA mainly uses three data sources: The Register of Employment Statistics (RAS), the Yearly Statistics on Earnings, and the LFS, where the RAS is the main source.	Hours worked are calculated based on the Yearly Statistics on Earnings in combination with the number of jobs obtained from the RAS.
France	Administrative sources are used to calculate government employment, while non-governmental employment is based on the Census in combination with administrative sources. The Labor Activity and Employment Conditions (ACEMO) Survey delivers information on part-time employment.	Also based Census, administrative data, and ACEMO. The LFS is an important secondary source that delivers additional information for corrections.
Germany	The German data on employment is based on a large number of different sources, covering administrative sources as well as the Microcensus (LFS), business reports, and a monthly telephone survey.	Hours worked are based on the IAB establishment survey and are estimated for full-time workers whose hours are not affected by absence. Annual estimates take into account public holidays & sickness absences, overtime, short-time, weather, etc., information on which is obtained from a large number of different sources. Hours worked by part-time employees, self-employed, or unpaid family workers are calculated using the Microcensus.
Greece	The main data source is the LFS, but for some sectors and industries more specific surveys are used because they are assumed to be more accurate (e.g. the Survey of the Structure of Crop and Livestock Holdings, the Annual Sea Fishery Survey, or the Annual Statistical Survey on Mines, Quarries and Salterns).	Hours worked are based on the LFS.
Hungary	Employment data is solely based on the LFS, adjusting only to agree with the domestic concept.	Hours worked are calculated based on actual hours worked in the LFS.
Ireland	Employment numbers are based on the Quarterly National Household Survey (QNHS).	Hours worked estimates are based on the QNHS.
Italy	Employment numbers are based on very complex estimation method that draws on a lot of different data sources, the most important ones being the Census of Industry, Services and Institutions, the Population Census, and the LFS.	Whenever possible, hours worked are based on business surveys and labor cost statistics; otherwise LFS data are used.
Netherlands	Statistics Netherlands produces labor accounts (including statistics on employment) using different sources: LFS, establishment surveys, administrative registers, and the Social Statistical Database.	Hours worked by employees are also part of the labor accounts and use the same sources, whereas hours for self-employed are based on the LFS.
Norway	Statistics Norway estimates employment numbers from a number of different data sources, e.g. establishment surveys, labor force survey and public sector accounts.	For employees, hours are based on a range of sources like wage statistics, the LFS, or employee registers. Hours for self-employed are based solely on the LFS.

Poland	The Central Statistical Office of Poland computes employment numbers based on several enterprise surveys.	Hours data for employees come from the annual survey on employment, earnings, and hours worked (business survey).
Portugal	The main source for Portuguese employment is the LFS.	Hours worked are mainly based on the LFS.
Spain	Employment numbers are based on several different sources, the main ones being the Structural Business Surveys (SBS) and the LFS.	The SBS and the Economically Active Population Survey (EPA) are the main source for the calculation of hours worked, but are combined with other surveys for adjustments.
Sweden	The main source for employment is the LFS in combination with Structural Business Statistics (SBS) and the Business Register.	The LFS and SBS are the main sources for hours, but Labor Statistics based on administrative sources are used as secondary sources.
Switzerland	Employment numbers are calculated using the LFS, the Central Aliens Register, and Job Statistics (business survey).	Total hours worked are based on LFS, taking into account absences, overtime and additional jobs. Some adjustments are based on other sources (e.g., the Swiss health survey for sick leave).
United Kingdom	The main sources for employment are the LFS, business surveys, and some administrative sources.	Hours worked are compiled using LFS data on hours worked in first and second jobs by employees and the self-employed, which are combined with business survey data on the allocation of jobs.
United States	The main source for employment data is the BLS Quarterly Census of Employment and Wages (QCEW), which counts all employees covered by UI laws (adjustments are made for other employees).	Upward revised estimates obtained of the annual hour per worker series by the BLS. These are derived from the CES for production and non-supervisory workers in private sector jobs, imputed for non-production and supervisory workers, and taken from the CPS for proprietors and unpaid family workers.

Description of sources is based on the joint OECD/Eurostat questionnaire for National Accounts employment and hours worked.

<http://ec.europa.eu/eurostat/web/national-accounts/methodology/member-states-accounts/employment-questionnaires>

Figure W.21: Percentage Point Deviation of Employment Rate in NIPA from LFS



W.4.2 Employment Rate in NIPA and LFS

The NIPA employment rate estimate from the OECD exceeds the LFS estimate in 13 out of 19 countries (on average by 3.3%, or 2.2 percentage points), although only in the US, Hungary, and Poland the NIPA estimate is lower in an economically significant way. While Figure 5b uses same unit (percent) for the employment rate as for hours worked per employed to facilitate the comparison between the two variables, Figure W.21 shows the percentage point differences as this facilitates the decomposition exercise we conduct in this section. The wide white bars show for each country the percentage point difference between the NIPA and LFS employment rate differences.

The OECD provides additional information that allows to investigate at least partially the sources of the differences between NIPA and LFS employment rate estimates. Specifically, the OECD’s “Annual Labor Force Statistics” (*ALFS*) report employment in the Armed Forces (*AF*), i.e. non-civilian employment. The OECD’s “National Accounts Database” (*NA*) also reports employment according to the national concept (*NC*). Relative to NIPA employment, which is based on the domestic concept, this excludes any foreign residents working domestically but includes all

residents working abroad. We decompose the percentage point difference between the NIPA and LFS employment rate estimates as follows:

$$\begin{aligned}
\frac{Emp^{NIPA}}{Pop_{15-64}^{ALFS}} - \frac{Emp^{LFS}}{Pop_{15-64}^{LFS}} &= \underbrace{\frac{Emp^{LFS} + Emp_{AF}^{ALFS}}{Pop_{15-64}^{LFS} + Emp_{AF}^{ALFS}} - \frac{Emp^{LFS}}{Pop_{15-64}^{LFS}}}_{=\Delta 1} \\
&+ \underbrace{\frac{Emp^{LFS} + Emp_{AF}^{ALFS}}{Pop_{15-64}^{ALFS}} - \frac{Emp^{LFS} + Emp_{AF}^{ALFS}}{Pop_{15-64}^{LFS} + Emp_{AF}^{ALFS}}}_{=\Delta 2} \\
&+ \underbrace{\frac{Emp_{NC}^{NA}}{Pop_{15-64}^{ALFS}} - \frac{Emp^{LFS} + Emp_{AF}^{ALFS}}{Pop_{15-64}^{ALFS}}}_{=\Delta 3} \\
&+ \underbrace{\frac{Emp^{NIPA}}{Pop_{15-64}^{ALFS}} - \frac{Emp_{NC}^{NA}}{Pop_{15-64}^{ALFS}}}_{=\Delta 4}
\end{aligned} \tag{W.1}$$

In each row of Equation (W.1) the first summand expands the concept of the employment rate, and is then again subtracted in the next row.

$\Delta 1$ quantifies how much of the difference between NIPA and LFS employment rate estimates is due to the lack of data on Armed Forces in the LFS. For Belgium, Switzerland, Greece and Sweden there is no information on employment in the Armed Forces (*AF*) in the *ALFS*, but Figure W.21 shows that in the remaining countries including the Armed Forces generates negligible differences in the employment rate. This can be best seen from the comparison with the white, wider bars labeled “ Δ NIPA-LFS” in the background which represent the overall percentage point differences.

$\Delta 2$ reflects the additional contribution of the larger population in the NIPA data compared to the LFS plus *AF* population, see the denominator. This larger population comes from the “further groups” in the age group 15 to 64 in Figure 4 and should lead to a negative value of $\Delta 2$ for all countries. This is however not the case for Italy and Portugal, suggesting some inaccuracies between the *ALFS* and LFS population figures. In the remaining countries the difference ranges from virtually zero percentage points in the Czech Republic to over 2 percentage points in the US, Switzerland, Spain, Greece, and the UK.

$\Delta 3$ quantifies the difference between employment in the *NA* using the national concept (*NC*) and employment in the LFS plus *AF* (expressed relative to the total population aged 15-64), i.e. in principle this should be the employment of the “further groups” that were added to the population in $\Delta 2$. We should thus see a positive difference. However, there are again 6 countries for which this is not the case (Austria, Denmark, Hungary, Poland, Portugal and Sweden), although these negative differences are generally small. For the US, the difference is with less than one percentage point small as well. In most of the remaining countries, $\Delta 3$ is the largest among the different

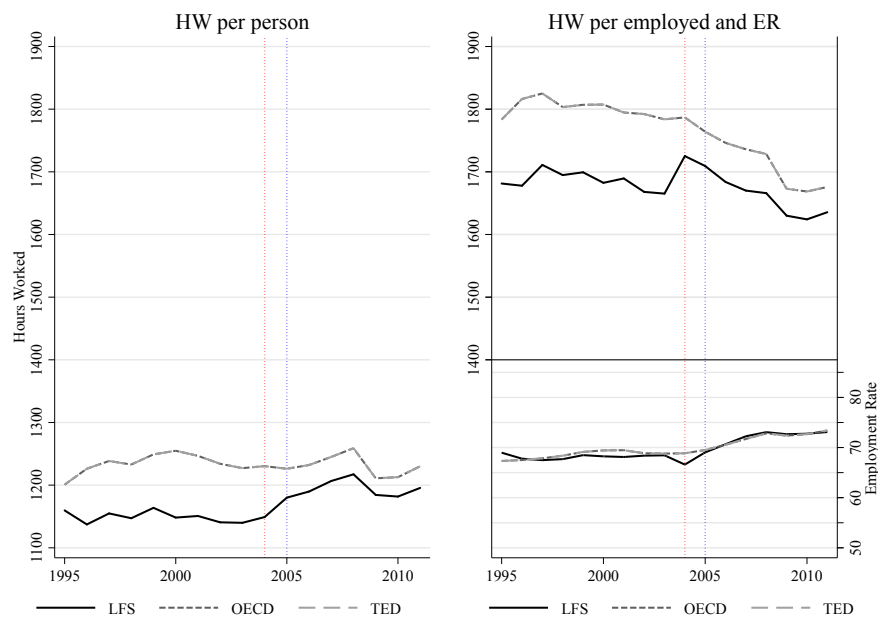
components. In Germany, Spain, France, and Italy, the differences are quite large amounting to more than 4 percentage points. At first glance, this seems surprising, given the comparatively small size of the population in the “further groups”, as can be at least partially indirectly inferred from $\Delta 2$. Focusing on Germany, the German Statistical Office (Destatis), see [Köerner and Marder-Puch \(2015\)](#), reports that this population barely contributes to the observed difference for Germany. The difference is rather generated by judgmental adjustments to the LFS data applied by Destatis to employment of the same covered population (i.e. civilian, non-institutionalized residents of a country aged 15 and older that do not work in a foreign country; the intersection in Figure 4). These judgmental adjustments are based on additional evidence, particularly for additional jobs (even though these are explicitly asked for in the labor force survey) and for the shadow economy (even though there is no explicit question about the legal status of a job in the labor force survey). It seems reasonable to assume that this applies also to the remaining countries with large difference between *NA* employment under the national concept and LFS employment. Put differently, these different judgmental adjustments by national statistical agencies are quantitatively important and the most important driving force of employment rate differences in NIPA and LFS data. Some countries, e.g. Austria and Sweden, seem to abstain from implementing any kind of judgmental adjustment to LFS data, while in other countries it is substantial.

Finally, $\Delta 4$ reflects the differences in employment solely based on the location of employment by comparing NIPA employment under the domestic concept and *NA* employment under the national concept. Only for Switzerland and Hungary this is qualitatively important in absolute terms.

Overall, the difference between *NA* employment under the national concept and LFS employment plus employment in the Armed Forces is with a few exceptions the most important contributor to differences between the NIPA and LFS employment rate estimates. Explaining however the exact sources for the differences between *NA* employment according to the national concept and LFS employment is beyond the scope of this paper, since these judgmental adjustments are based on country-specific methods and country-specific data bases.

W.4.3 Time Series for Hours Worked and Employment Rates from the Three Data Sources

Figure W.22: Austria



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Figure W.23: Belgium



Figure W.24: Czech Republic

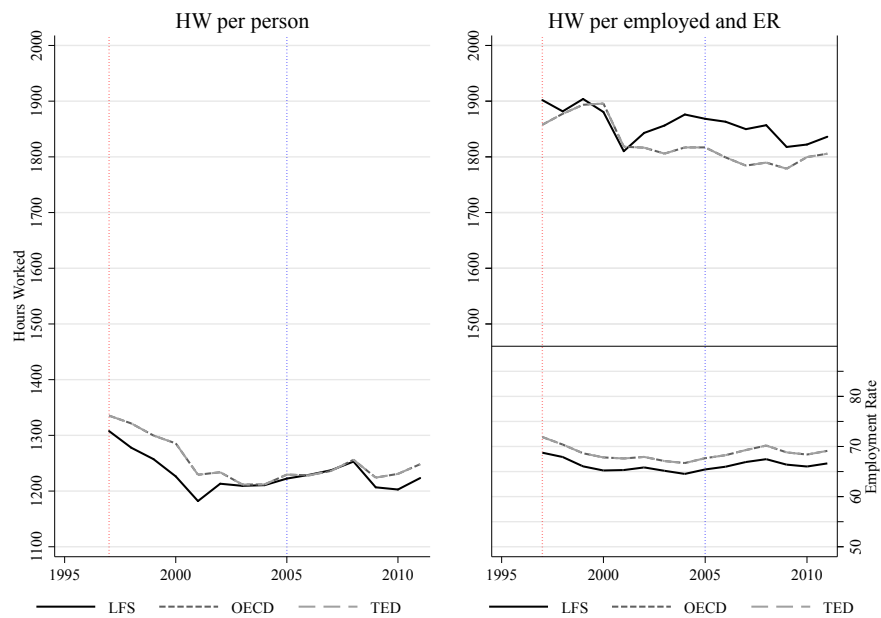


Figure W.25: Denmark



Figure W.26: France

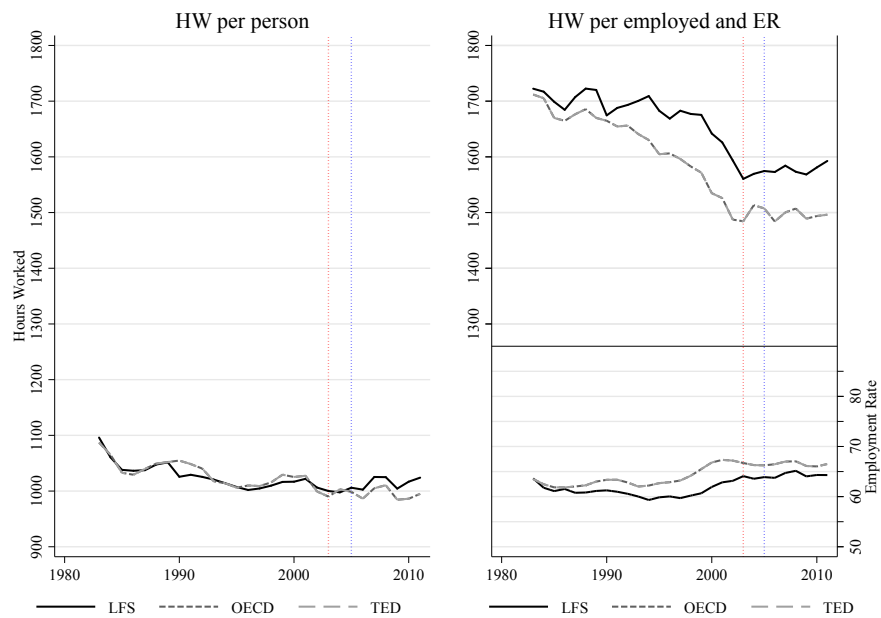


Figure W.27: Germany

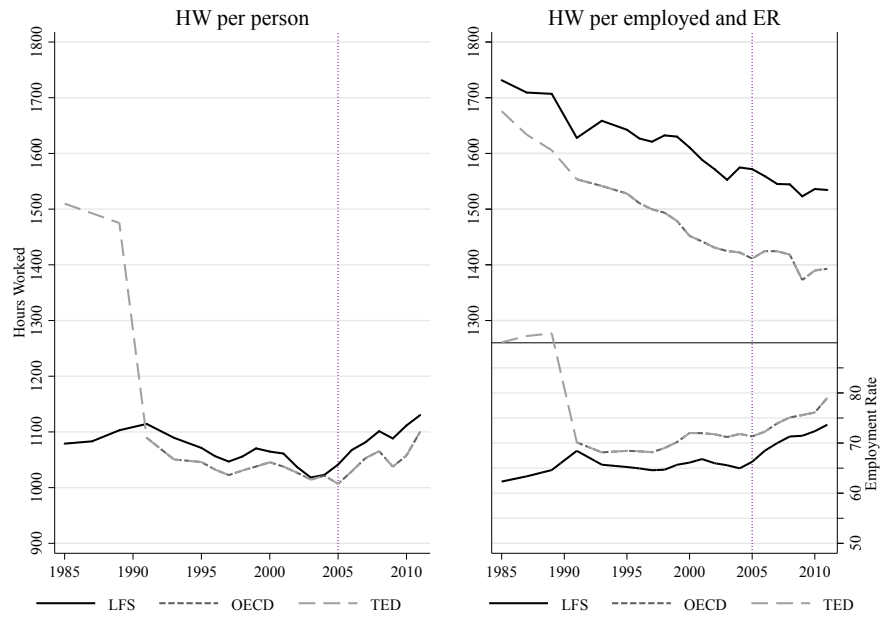


Figure W.28: Greece

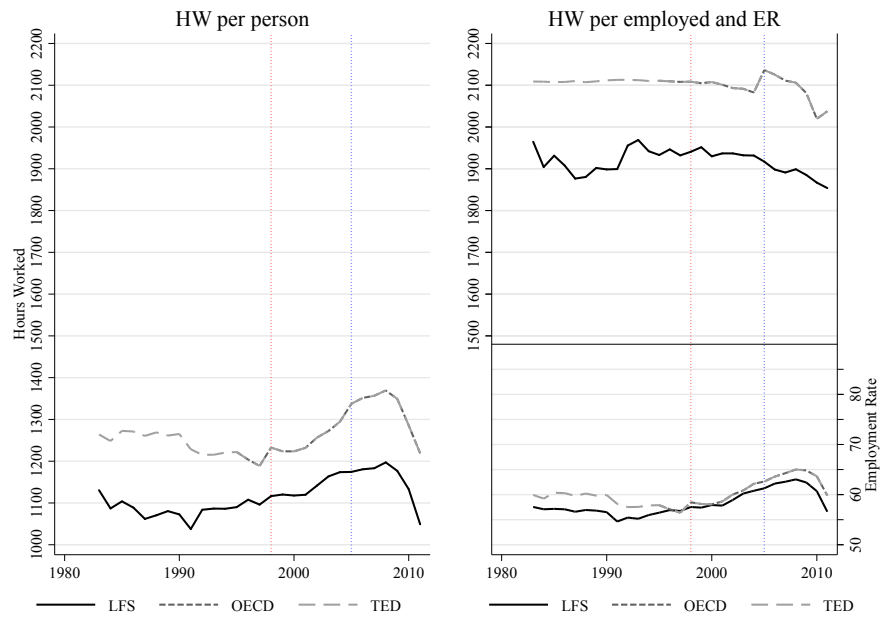


Figure W.29: Hungary

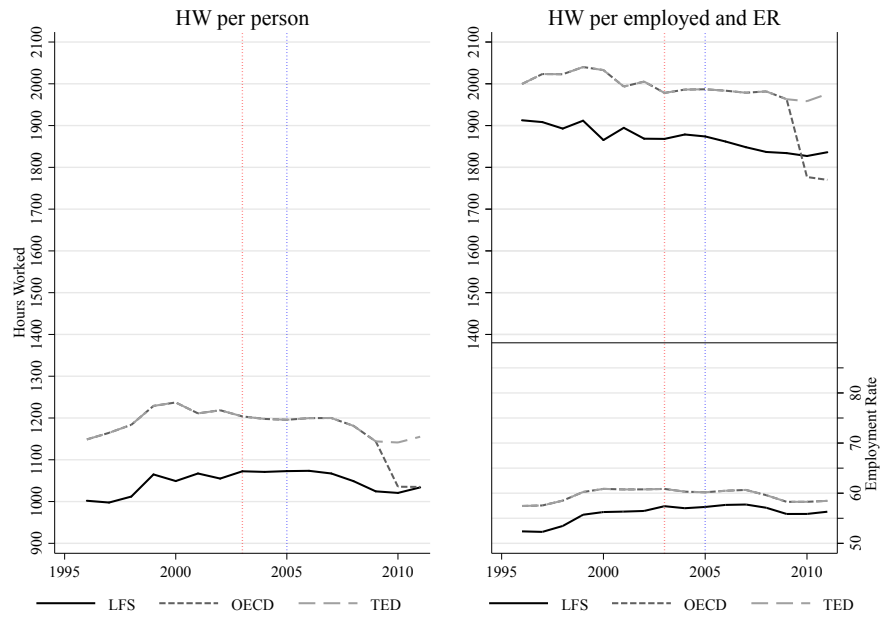


Figure W.30: Ireland

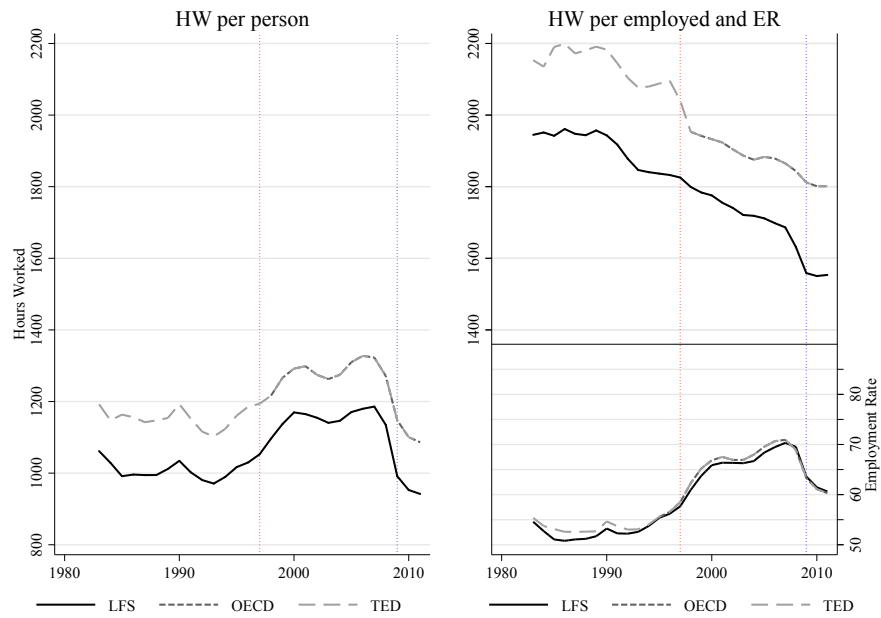


Figure W.31: Italy

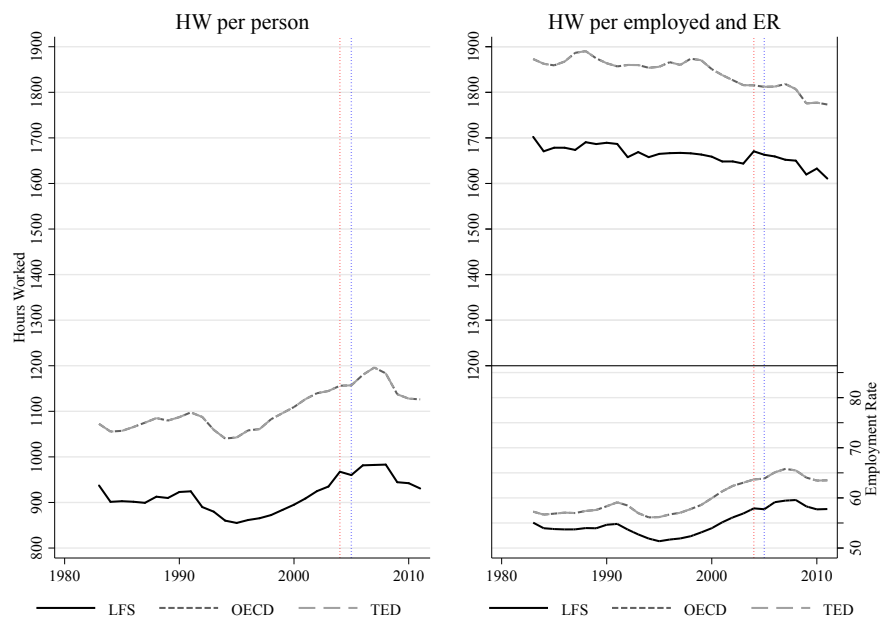


Figure W.32: Netherlands

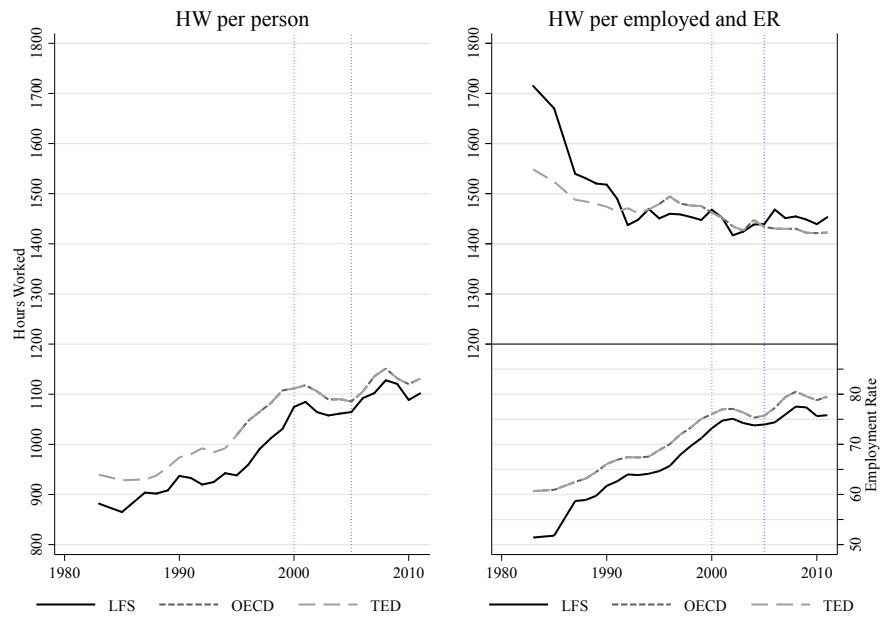


Figure W.33: Norway

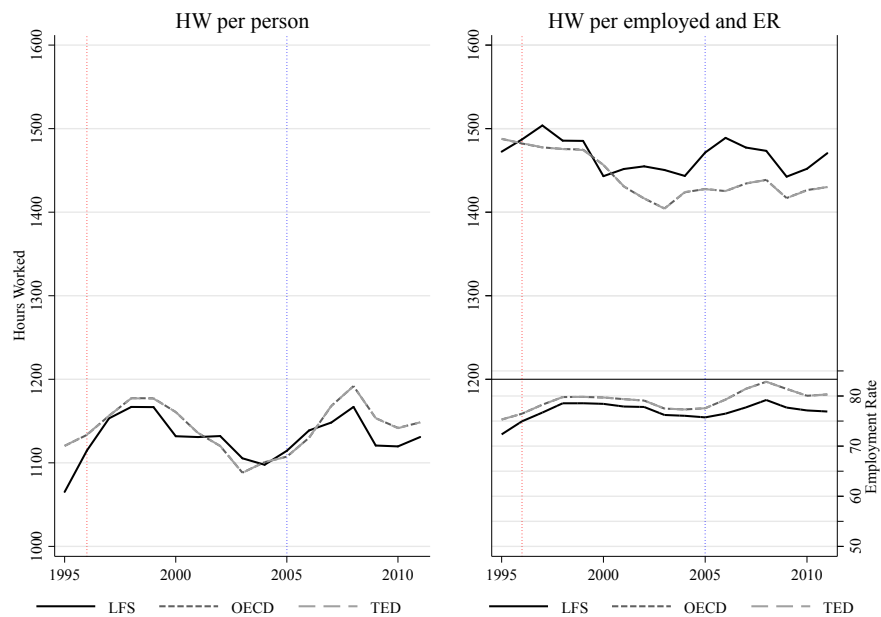


Figure W.34: Poland

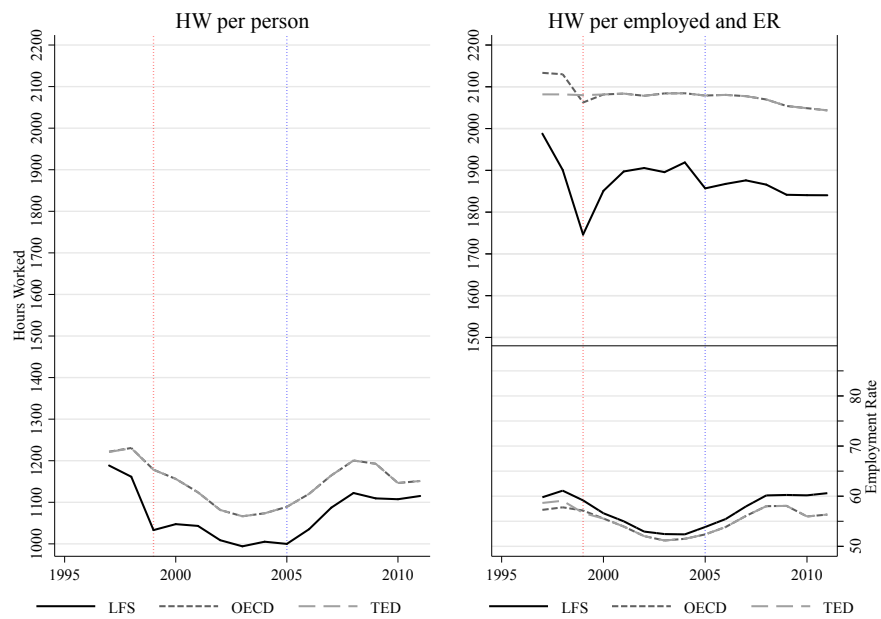


Figure W.35: Portugal

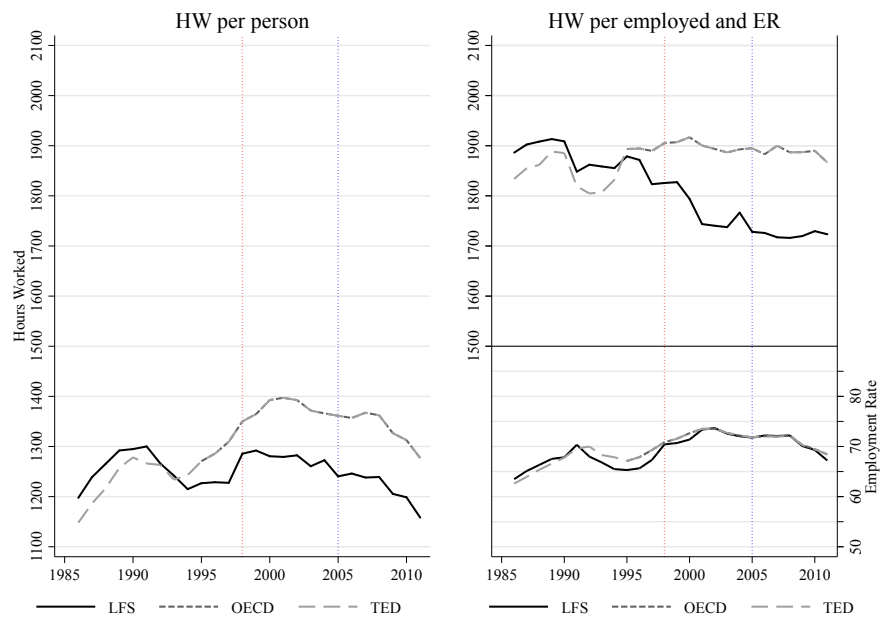


Figure W.36: Spain

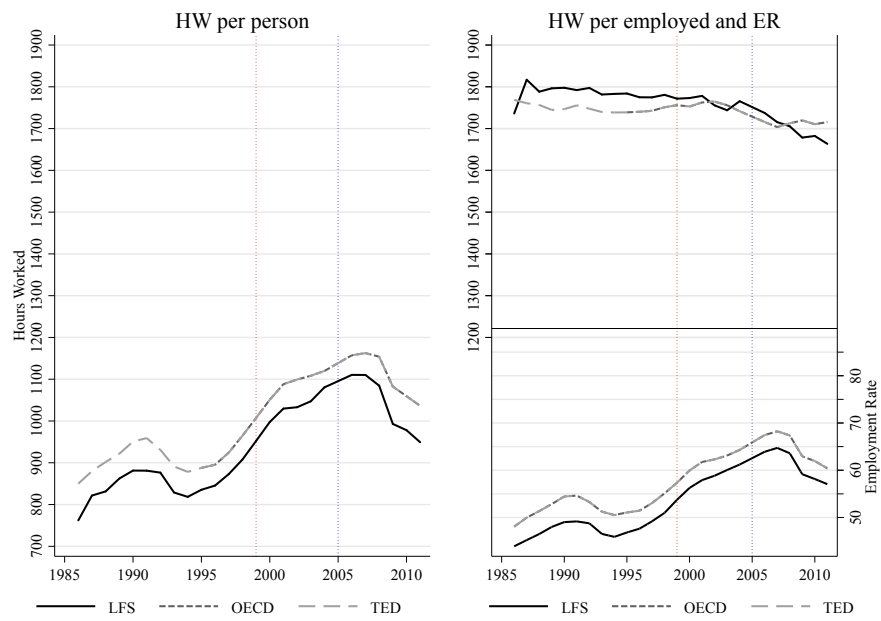


Figure W.37: Sweden

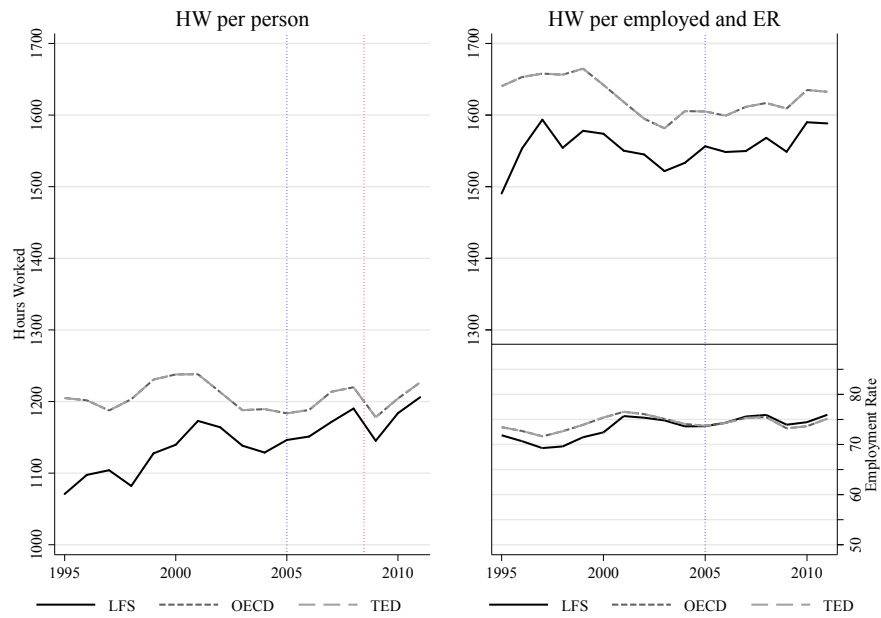


Figure W.38: Switzerland

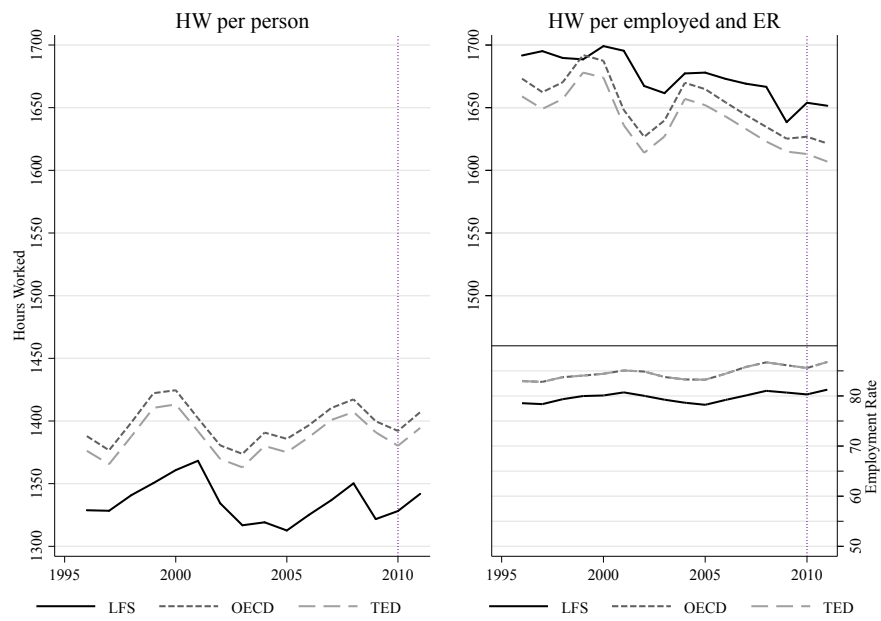


Figure W.39: United Kingdom

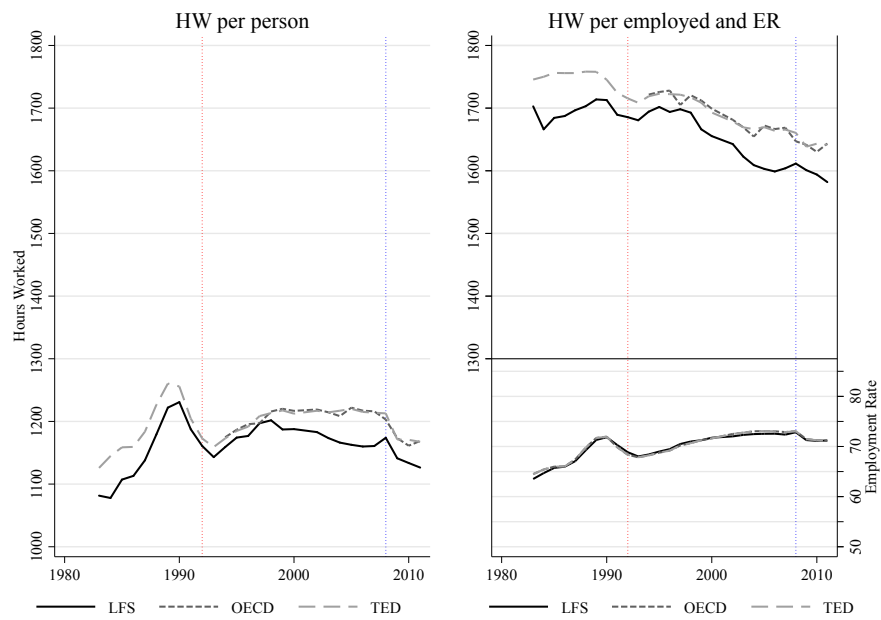
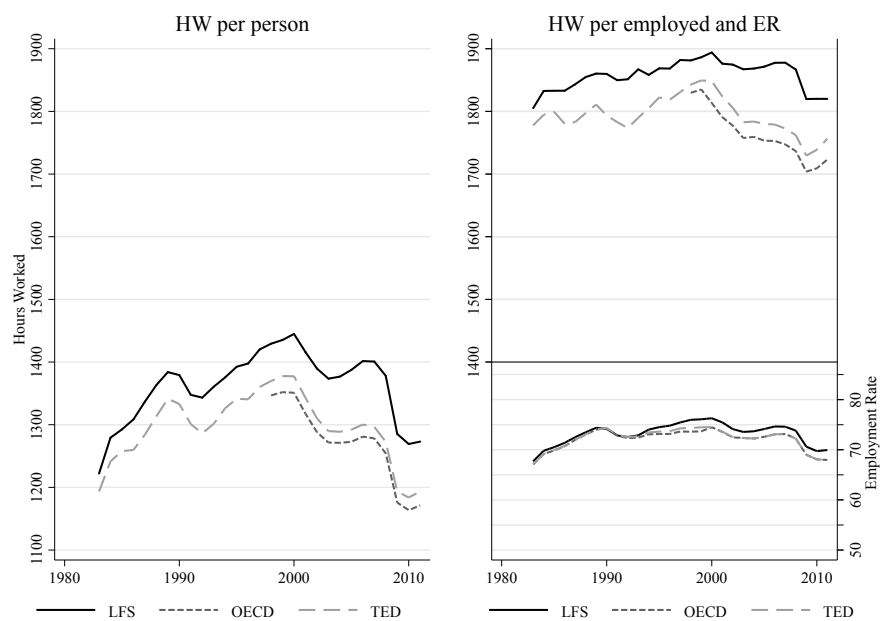


Figure W.40: United States



W.4.4 Data Revisions in OECD and TED and the Europe-US Hours Gap

The papers by [Prescott \(2004\)](#), [Rogerson \(2006\)](#), [Ohanian et al. \(2008\)](#), [McDaniel \(2011\)](#), and [Ragan \(2013\)](#) all use OECD and/or TED data to document hours across countries and over time, but relying on slightly different formulas, different data sets and different releases of these data sets. While some of these papers put more emphasis on the time series rather than the cross-section, the implied cross-sectional Europe-US gaps are of a similar magnitude as the one we find for the LFS data rather than the one for the NIPA data.²⁷

We provide an in-depth analysis of the different methodologies and data sets used in [Bick et al. \(2016\)](#). Here, we focus on a comparison to [Ohanian et al. \(2008\)](#), who work with data from the 2008 TED and OECD releases and make the data available on the *Journal of Monetary Economics* website. 2003 is the latest year available in their data with information for all variables, therefore we focus the comparison on that year. [Ohanian et al. \(2008\)](#), like [Rogerson \(2006\)](#), calculate hours worked per person as average hours worked per employed taken from TED multiplied by an employment rate constructed as civilian employment divided by the total population aged 15 to 64, both taken from the OECD. At least for the most recent release of the TED, hours worked per employed refer to total hours divided by total employment, such that employment does not cancel out in this calculation. While the first column of Table W.16 shows the hours gap to the US for each country based on the data and formula by [Ohanian et al. \(2008\)](#), the second column shows the same statistic if we use exactly the same formula as they do, but take new releases of their data. Specifically, we take in July 2016 hours worked per employed from the TED, and civilian employment and total population aged 15 to 64 from the OECD's "Annual Labor Force Statistics." Columns 3 to 5 show the hours gap to the US for the specific country if we calculate hours worked per person as we do in Section 3, using TED NIPA data in column 3, OECD NIPA data in column 4, and LFS data in column 5. The sole difference in the formula compared to [Ohanian et al. \(2008\)](#) lies in the fact that we use total employment rather than civilian employment as a numerator for the employment rate, such that employment cancels out in the calculation of hours worked per person. The Eastern European countries are not included in [Ohanian et al. \(2008\)](#) and thus are omitted in Table W.16.

Using the formula and original data from [Ohanian et al. \(2008\)](#) in column 1, we find a Europe-US hours gap of 17.6%. Using exactly the same formula but the most recent available data releases in column 2 yields a much smaller gap of 11.0%. Thus, revisions in the data between 2008 and today reduce the Europe-US hours gap in 2003 by 6.6 percentage points. By contrast, the differences between the Europe-US hours gap using the formula as in [Ohanian et al. \(2008\)](#) but the current releases of the data (column 2), or using our formula and current releases of the TED data for hours and employment (column 3) are with on average 1.1 percentage points minor. Thus, the differences between [Ohanian et al. \(2008\)](#) and our NIPA results based on TED data are not driven by the use of a slightly different formula. Instead, they are driven by substantial revisions in different data releases of TED data. In [Bick et al. \(2016\)](#) we show that especially hours worked per employed change dramatically between the 2008 TED release and subsequent releases of the same data. In addition, we show that OECD data, as used by [Ragan \(2013\)](#), are also subject to

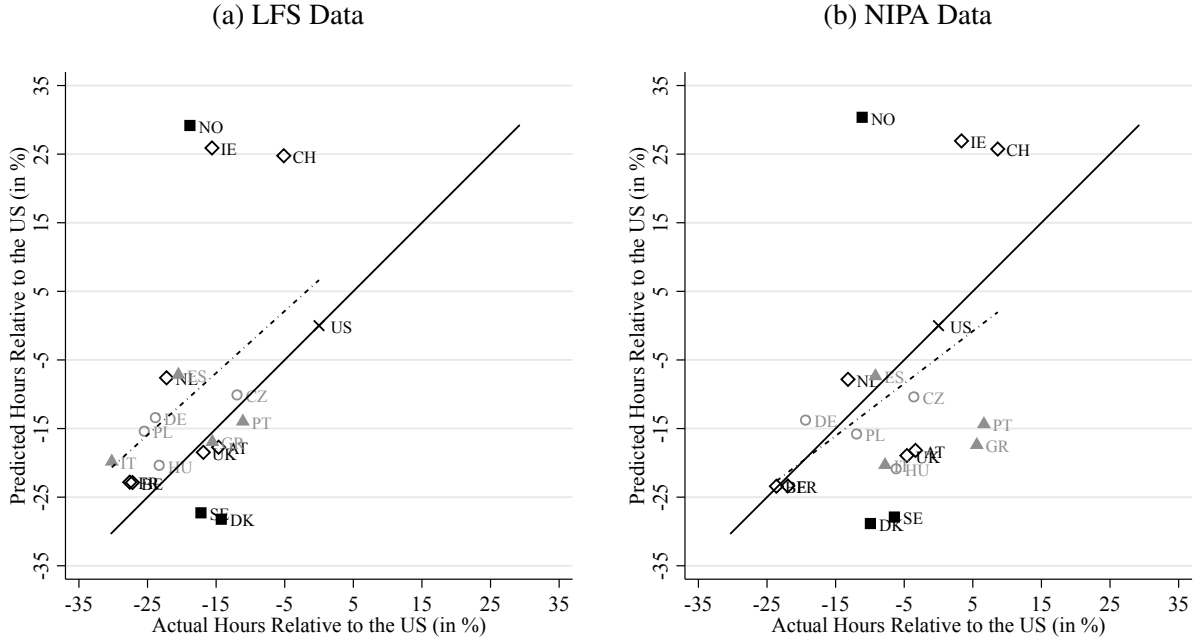
²⁷[Ragan \(2013\)](#) is an exception. While the underlying data used by her were subject to non-negligible revisions on the country level, the average Europe-US hours gap is nearly left unchanged.

Table W.16: Hours Worked per Person Relative to US Based on Different Calculations for the Year 2003

Country	<i>ORR</i>	Current Rel.	NIPA (TED)	NIPA (OECD)	LFS
Austria	−20.1	−3.8	−4.9	−3.5	−17.0
Belgium	−26.4	−25.6	−25.3	−24.3	−30.5
Denmark	−12.0	−11.6	−12.2	−10.9	−14.5
France	−30.7	−24.5	−23.2	−22.1	−27.2
Germany	−29.3	−27.3	−21.4	−20.2	−25.9
Greece	−10.5	−2.6	−1.4	0.0	−15.3
Ireland	−15.3	−1.3	−2.1	−0.7	−17.0
Italy	−29.7	−18.7	−11.3	−10.0	−31.9
Netherlands	−23.1	−16.7	−15.5	−14.3	−23.0
Norway	−21.6	−16.4	−15.6	−14.4	−19.5
Portugal	−5.9	7.3	6.3	7.9	−8.2
Sweden	−12.2	−9.2	−7.9	−6.6	−17.1
Spain	−19.3	−16.9	−14.1	−12.8	−23.8
Switzerland	0.2	7.5	5.7	7.2	−4.1
United Kingdom	−8.8	−4.9	−5.8	−4.5	−14.6
<i>Mean</i>	−17.6	−11.0	−9.9	−8.6	−19.3

substantial revisions. As the last column of Table W.16 shows, it turns out that the Europe-US hours gap in the original [Ohanian et al. \(2008\)](#) data set is quite similar to the one we find in LFS data.

W.5 Country-Specific Model Predictions



W.6 Decomposition Exercise

W.6.1 Aggregate Decomposition

In the aggregate decomposition, we quantify by how much each of the different components, i.e. the employment rate (e), weekly hours worked per employed in a non-vacation week (h), and weeks worked (w), contribute to the cross-country differences in aggregate hours worked per person (H) in country c :

$$H^c = e^c \times h^c \times w^c. \quad (\text{W.2})$$

Specifically, we want to measure the contribution of each margin to the difference of the country-specific hours relative to the US. Our decomposition exercise works as follows. We calculate the following three counterfactual hours $H^{c,i}$, $i = w, e, h$ by setting for every country one margin after the other equal to the corresponding US value, and then measuring the incremental fraction of the aggregate hours worked per person difference relative to the US accounted for by this margin Δ^i , $i = w, e, h$. To give a concrete example, consider the following ordering:

$$\begin{aligned} H^{c,w} &= e^c h^c w^{US} & \rightarrow \Delta^w &= \frac{H^c - H^{c,w}}{H^c - H^{US}} = \frac{e^c h^c (w^c - w^{US})}{H^c - H^{US}} \\ H^{c,e} &= e^{US} h^c w^{US} & \rightarrow \Delta^e &= \frac{H^{c,w} - H^{c,e}}{H^c - H^{US}} = \frac{(e^c - e^{US}) h^c w^{US}}{H^c - H^{US}} \\ H^{c,h} &= e^{US} h^{US} w^{US} & \rightarrow \Delta^h &= \frac{H^{c,e} - H^{c,h}}{H^c - H^{US}} = \frac{e^{US} (h^c - h^{US}) w^{US}}{H^c - H^{US}}, \end{aligned} \quad (\text{W.3})$$

$$\sum_{i=w,e,h} \Delta^i = 1. \quad (\text{W.4})$$

Δ^w measures what fraction of the hours worked per person difference relative to the US can be accounted for by differences in the work weeks. Δ^e measures what fraction of the hours worked per person difference relative to the US can be accounted for by differences in the employment rates, conditional on having already accounted for differences in the work weeks. Last, Δ^h measures what fraction of the overall difference can be accounted for by differences in the weekly hours worked per employed, conditional on having already accounted for differences in the work weeks and the employment rate. With three margins, there are six different possible orderings, and in general each ordering will be associated with a different incremental contribution of each margin to the aggregate hours worked per person differences relative to the US. Therefore, we do not report results from one specific ordering, like e.g. the one shown in Equation (W.3), but rather the mean over all six possible orderings.²⁸

Table W.17 reports in column 1 the hours worked per person difference relative to the US, i.e. $(\frac{H^c - H^{US}}{H^{US}}) \times 100$. In column 2 we report what fraction of the hours worked per person relative to the US can be accounted for by differences in the employment rates. Columns 3 and 4 report the same statistics for weekly hours worked and weeks worked, respectively. The three last columns add up to 1. A positive value indicates that a factor positively accounts for the (negative) difference, while a negative value means that the respective factor does not contribute to the (negative) difference, but would in fact indicate higher hours in the respective European country than in the US.

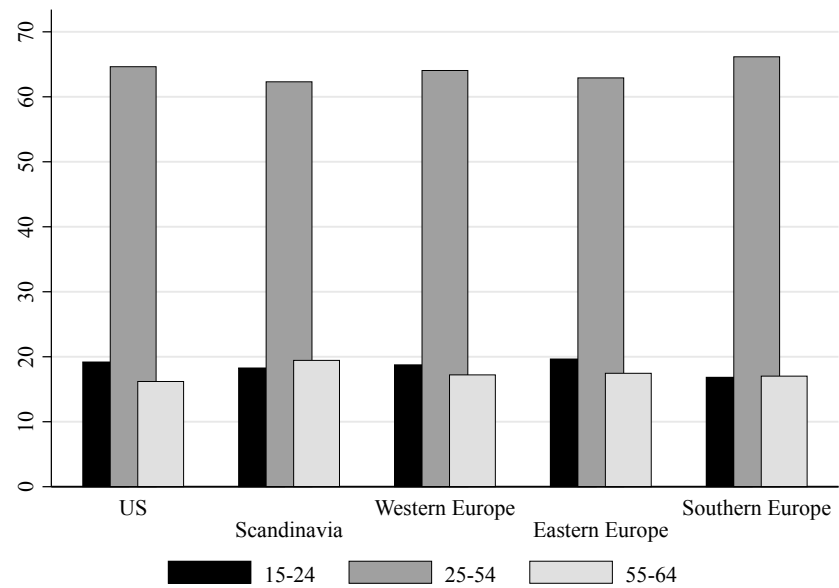
²⁸The average standard deviations across the six possible orderings are very small with 2.5 for Δ^e , 2.4 for Δ^h , and 2.6 for Δ^w , and the standard deviations never exceed 5, once Switzerland is excluded. For Switzerland, the standard deviations are 10.2 for Δ^e , 6.0 for Δ^h , and 6.9 for Δ^w . Alesina et al. (2005) perform a similar calculation, but do not consider the different orderings and change only one component at a time.

Table W.17: Aggregate Decomposition - Hours Worked per Person Relative to the US (in %)

Country	$\frac{H^c - H^{US}}{H^{US}}$	Δ^w	Δ^e	Δ^h
Denmark	-13.7	57.8	-46.1	88.3
Sweden	-16.1	43.6	-12.5	68.9
Norway	-18.0	35.7	-24.5	88.8
<i>Mean</i>	<i>-15.9</i>	<i>45.7</i>	<i>-27.7</i>	<i>82.0</i>
Switzerland	-4.0	161.6	-193.3	131.7
Austria	-13.2	59.3	18.4	22.3
Ireland	-15.0	30.5	31.8	37.7
United Kingdom	-15.8	38.5	5.5	56.0
Netherlands	-20.8	19.1	-13.3	94.2
Germany	-22.6	40.6	24.5	34.9
Belgium	-25.5	17.4	57.7	24.9
France	-26.0	33.5	38.4	28.0
<i>Mean</i>	<i>-17.9</i>	<i>50.1</i>	<i>-3.8</i>	<i>53.7</i>
<i>Mean w/o CH</i>	<i>-19.8</i>	<i>34.1</i>	<i>23.3</i>	<i>42.6</i>
Czech Republic	-10.4	65.2	84.2	-49.4
Hungary	-21.6	18.6	92.4	-11.0
Poland	-24.4	19.6	96.3	-15.8
<i>Mean</i>	<i>-18.8</i>	<i>34.5</i>	<i>90.9</i>	<i>-25.4</i>
Portugal	-12.9	59.9	42.7	-2.6
Greece	-14.9	41.9	101.8	-43.7
Spain	-19.1	36.0	54.5	9.5
Italy	-29.4	27.0	61.2	11.8
<i>Mean</i>	<i>-19.1</i>	<i>41.2</i>	<i>65.1</i>	<i>-6.3</i>

W.6.2 Demographic Structure: Age Composition

Figure W.42: Age Composition



W.6.3 Disaggregate Decomposition with Heterogeneous Weeks Worked

Table W.18: Disaggregate Decomposition, Heterogeneous Weeks Worked (age x gender x educ x sector)

Country	$\frac{H^c - H^{US}}{H^{US}}$	Δ^w	Δ^f	Δ^e	Δ^h	Δ^s
Denmark	-13.0	56.8	41.1	-71.0	77.4	-4.3
Sweden	-16.2	44.5	30.2	-42.5	67.8	-0.1
Norway	-18.0	37.8	20.4	-40.1	83.8	-1.9
<i>Mean</i>	<i>-15.7</i>	<i>46.4</i>	<i>30.6</i>	<i>-51.2</i>	<i>76.3</i>	<i>-2.1</i>
Switzerland	-3.5	192.6	90.0	-278.2	111.4	-15.8
Austria	-13.0	71.6	31.9	-14.6	20.5	-9.4
Ireland	-14.7	35.2	51.6	-16.7	42.1	-12.2
United Kingdom	-15.6	41.3	48.0	-38.3	49.7	-0.7
Netherlands	-20.8	22.3	33.6	-34.3	70.7	7.8
Germany	-22.7	44.1	20.9	5.9	31.4	-2.3
Belgium	-25.5	18.7	28.7	24.5	28.7	-0.6
France	-25.9	36.5	28.2	9.1	28.4	-2.3
<i>Mean</i>	<i>-17.7</i>	<i>57.8</i>	<i>41.6</i>	<i>-42.8</i>	<i>47.9</i>	<i>-4.4</i>
<i>Mean w/o CH</i>	<i>-19.7</i>	<i>38.5</i>	<i>34.7</i>	<i>-9.2</i>	<i>38.8</i>	<i>-2.8</i>
Czech Republic	-10.3	78.5	37.8	23.4	-37.2	-2.5
Hungary	-21.5	24.4	33.2	50.6	-5.9	-2.3
Poland	-24.1	28.7	25.3	61.9	-11.3	-4.7
<i>Mean</i>	<i>-18.6</i>	<i>43.8</i>	<i>32.1</i>	<i>45.3</i>	<i>-18.1</i>	<i>-3.1</i>
Portugal	-12.9	87.2	63.8	-43.8	-5.7	-1.4
Greece	-14.3	62.3	22.7	47.2	-33.2	0.9
Spain	-19.0	43.3	32.2	10.9	15.8	-2.1
Italy	-29.2	33.0	27.6	22.2	17.9	-0.7
<i>Mean</i>	<i>-18.8</i>	<i>56.4</i>	<i>36.6</i>	<i>9.1</i>	<i>-1.3</i>	<i>-0.8</i>
<i>Mean w/o PT</i>	<i>-20.8</i>	<i>46.2</i>	<i>27.5</i>	<i>26.8</i>	<i>0.1</i>	<i>-0.6</i>