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Desired hours worked over the business cycle: stylised facts for European Countries

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TEP Working Paper No. 1320

August 2020

Trinity Economics Papers
Department of Economics

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August 4, 2020

ABSTRACT:

This paper documents stylised facts on desired hours per employed worker in European countries and identifies the effect of recessions on desired hours. Actual hours worked are usually used to estimate preferences on the labour market. However, actual hours are constrained by labour demand and therefore measure hours worked in the general equilibrium. Descriptive statistics from EU Labour Force Survey show that desired hours are countercyclical and that the underemployment gap increases due to higher desired hours worked of employed individuals. I identify the effect of recessions on desired hours using variation in regional unemployment rates from 2000 to 2017. I find that a 1 percentage point higher unemployment rate increases desired hours, on average, by 2 - 8 hours on a yearly level (3 - 5 minutes in the reference week). The results offer a lower bound estimate for the whole sample period of booms and busts. To narrow the sample period, I use a panel of individuals from the French LFS (EEC) and find even bigger effects. In France, from 2007q4 to 2009q1, an increase in regional unemployment rate by 1 percentage point increases desired hours by 1.6 hours in the reference week. Bottom decile of the income distribution significantly increases desired hours in all countries, suggesting an income effect labour supply response in recessions.

Key words: desired hours worked, labour supply, underemployment, recession
JEL codes: E24, E32, J22

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1 Introduction

Desired hours reveal true individual preferences on the labour market, as they are unconstrained by labour demand, which makes them fundamentally different from actual hours. Actual hours, usually used in the estimation of preferences, are a result of *both* labour supply and labour demand at a given point in time. It is common, especially during recessions, that individuals would like a full-time paying job, however they settle for a part-time job, due to the lack of availability of full-time jobs or other outside options.

This paper documents stylised facts on desired hours per employed worker, *over time and cross-country*, identifies the effect of recessions on desired hours and investigates possible reasons for the patterns found. I find that desired hours (true labour supply) are increasing in recession periods and decreasing in boom periods in 12 European countries.

This paper contributes to multiple literature strands: First, descriptive facts presented in the first part of this paper show that there is labour market slack in Europe (defined as the difference between desired and actual hours worked). If the labour market is slack, the unemployment rate does not fully capture the available labour supply in the economy. To shed light on where the slack comes from, I break down desired hours by individual characteristics. Second, precautionary savings theory states that in the presence of an income risk, individuals would consume less and save more. Changes in desired hours during recession periods, when income risk is higher, could signal the precautionary labour supply and explain the precautionary savings mechanism. Jessen et al. (2018) use German socio-economic panel data to show that German individuals choose 2.8% hours worked more to shield themselves against wage shocks. Third, it is common to assume that higher underemployment in recessions increases due to labour demand adjustments. However, if desired hours increase during recessions, the underemployment gap would be driven by the higher labour supply. Similar was shown by Bell and Blanchflower (2018) who also use desired hours worked to calculate over- and under-employment and use it in their Phillips curve estimation. Fourth, real business cycle literature assumes that substitution effect is possible only for a higher wage. Assuming that wage = marginal product of labour, an increase in wages increases the opportunity cost of leisure. This paper shows evidence of the opposite: employees from the bottom of the income distribution would like to work more hours during recession periods.

I analyse desired hours, 1998 - 2017, in 12 European countries Austria, Belgium, Czech Republic, Germany, Spain, France, Greece, Ireland, Poland, Portugal and UK¹, using EU Labour Supply Survey (LFS). The first part of the paper presents descriptive statistics on desired hours per employed individual: descriptive statistics show that desired hours are countercyclical. In addition, the underemployment gap is driven by changes in desired hours, rather than actual hours.

The effect of recessions on desired hours is identified using the variation in regional (NUTS 2) unemployment rates over time, for each country in my sample. Desired hours on average increase for an increase in the regional unemployment rate, during the period 1998 - 2017 for most countries. The magnitude of the effect varies from 3-5 minutes in the reference week in Germany, Czech Republic and Poland, to 9 minutes in Spain. Assuming the same for the whole year, the effect would vary from 2 - 8 hours per year. However, the effect is negative or statistically insignificant for some countries, like France and UK. Using a panel of individuals from French LFS (Enquête emploi en continu - EEC), I show that higher unemployment rates

¹I selected these countries because there was the least missing observations in variables of interest and there was enough variation in desired hours within each country.

increase desired hours by 1.6 hours in the reference week, in the period when the Great Recession started (2007q4 - 2009q1). This suggests that relatively small effects of 3-5 minutes per week are much larger during recessions.

Desired hours are collected for employed individuals, regardless of whether they would like to work more or less than their current actual hours. Since desired hours are not collected for unemployed individuals, labour market slack, underemployment and the effect of recessions on desired hours is only the lower bound estimate of the true effect. Any concerns that unobservable characteristics could affect the employment status (for example, that more conscientious individuals remain employed in recessions) are controlled for in the estimation for France using panel data, by adding individual fixed-effects. The effect in France at the onset of the Great Recession, is even larger than the average effect over the whole sample period and without controlling for individual unobservable heterogeneity. This indicates that the sample selection biases the average estimations down.

There are several possible explanations for this pattern of desired hours. One is precautionary labour supply, as discussed above. Second is a wealth effect: if individual's assets (housing or financial assets) lost value during recessions, she would likely want to work more hours to compensate for the wealth loss. Third, income effect could be in place: for lower labour income, individuals would want to work more hours. In this paper, I focus on the income effect due to data limitations - EU LFS provides only income decile from 2009 and there is no wage or asset information available. However, labour income loss can come from different sources: in recessions part-time work becomes more prevalent (as discussed in Borowczyk-Martins and Lale (2019) for the US and UK), temporary contracts are more common, partners lose jobs so the household income declines, paid overtime work is less common, while unpaid becomes more common. Results show that individuals in the lower part of the income distribution desire more hours worked for an increase in unemployment rate. The magnitude of the effect is even larger than the average effect, ranging from 8 minutes in the reference week in France to 42 minutes in Ireland. Additionally, part-time and temporary workers increase desired hours, for a higher unemployment rate, in countries where part-time and temporary work was a common adjustment to the recession shock². In Ireland, part-time workers account for almost half of the effect in the bottom part of the income distribution. Similarly, in Portugal, where temporary work is among the highest in Europe, temporary workers desire 10 minutes more in the reference week, for a higher unemployment rate.

The paper that is the closest to my paper in methodology and results is Lazear et al. (2016). The authors use state-level variation in unemployment rates to show the effect of the recession on productivity in the US. The increase in productivity is mostly attributed to higher effort in the recession, because upskilling accounts for only 30% of the productivity increase. The authors speculate that higher effort in recessions could be a result of lower outside options when labour demand is low. If leisure is the next best thing, workers are likely to increase effort for a constant wage. My analysis confirms this story for countries where wages have remained constant over the business cycle.

The rest of the paper is as follows: Section 2 details the variable desired hours worked and the sample, Section 3 presents descriptive statistics on desired and actual hours over time, for each country in the sample and Section 4 complements these stylised facts with institutional framework relevant in the interpretation of the results. Section 5 discussed the effect of recessions on desired hours and Section 6 investigates the income effect. Section 7 concludes.

²Borowczyk-Martins and Lale (2019) find that in the US and UK recessions, labour demand was adjusted on the intensive margin.

2 Data

This paper uses yearly³ repeated cross-sectional Labour Force Survey (LFS) data, published by Eurostat. Respondents are individuals older than 15, which is the lower working age limit in most European countries. Desired hours are collected from 1998 onwards, although most countries collect them in later years. In this paper, I focus on 12 European countries. Table 1 shows the full sample for each country, from the sample beginning indicated in the table until 2017.

The sample is restricted to employed individuals, because the variable of interest - desired hours worked - is not collected for the unemployed. At this point, it is important to address valid concerns that sample selection would bias the results in this paper. If labour market slack and underemployment are higher during recessions, due to changes in desired hours of employed individuals, we can expect that true amounts are even bigger in reality, as more unemployed individuals would like to work some positive number of hours. Similarly, the effect of recessions on desired hours is only the lower bound estimate of the true effect. Any concerns that unobservable characteristics could affect the employment status (for example, that more conscientious individuals remain employed in recessions) are controlled for in the estimation for France using panel data, by adding individual fixed-effects. The effect in France at the onset of the Great Recession, is even larger than the average effect over the whole sample period and without controlling for individual unobservable heterogeneity. This indicates that the sample selection biases the estimations down.

LFS questionnaire contains questions related to desired hours worked and is asked to employed individuals. Individuals are flagged as employed if they worked any positive number of hours in the reference week. Three questions are asked in the following order:

1. Do you wish to work more than the current number of hours?
2. What is the way you would like to work more hours?
3. What is the total number of hours you would ideally like to work?

Desired hours could be affected by many confounding factors, therefore it is important to note that the questions on desired hours are asked in a way to indicate a corresponding increase in labour income, for a given wage rate. If an individual answers yes to the first question, they indicate how they would like to achieve those hours: through an additional job, current job, with a different job offering more hours worked or all of the above. Table 1 shows that the most individuals who want to work more hours, would like to do so through their current job. This is probably due to a cost of job search. Second most common choice is any of the ways offered in the survey.

³LFS also publishes quarterly data, however some variables relevant for my analysis are not available in the quarterly datasets.

Table 1: Descriptive statistics on desired hours worked

Statistic	AT	BE	CZ	DE	ES	FI	FR	GR	IE	PL	PT	UK
Sample beginning	1998	1999	2002	2005	1999	1998	2003	1999	1998	2000	1998	1999
Average desired hours	36.3	40.8	39.4	36.2	39.3	37	37.7	41.6	36.9	40.5	40.3	38.2
SD desired hours	1	1.6	.3	.5	1.3	.3	.2	.7	.5	.3	1.2	.4
Average actual hours	37.4	36.5	40.8	36.2	37.9	36.3	36.7	41.4	36.4	39.7	38	35.5
SD actual hours	1.6	.5	1.3	1.1	.7	.6	1.1	.5	1.5	.4	.7	.3
Employment rate	95.9	91.9	93.3	93.2	85.5	91.8	90.2	85.1	91.3	89.9	90.2	94.5
% wish to work more hours	6.8	8.2	1.1	5.6	6	5	15.1	6.4	9.1	7.3	12.6	7.2
...through an additional job	13.7	7	5.4	14	3.7	4.6	4.6	14.5	.7	19.2	4.6	9
...through a different job	16.2	9.2	23.1	10.9	14.1	12.1	5.7	11.9	1.9	20.6	9.7	16.3
...through current job only	58.3	70.7	54	59.2	40.2	60.9	68.6	34.9	46	47.1	62.7	55.7
...any of the above	11.8	13.1	17.6	15.9	35.7	22.2	18.7	38.7	47.1	13.1	22.6	18.7

Notes: The sample period for each country starts in the *Sample beginning* year and ends in 2017. Employment rate is included for cross-country comparison only. Average desired and actual hours are calculated per employed individual. % *wish to work more hours* is a share of employed individuals who want to work more hours.

The next section establishes stylised facts on desired hours graphically over time and cross-country. These stylized facts are then formally tested in Section 5.

3 Desired hours worked over the business cycle

Table 1 shows there is substantial heterogeneity in average desired hours across countries. However, time dimension is more informative, as it offers a common pattern for all countries in the sample. This section establishes two stylized facts on desired hours over the business cycle in selected European countries:

Stylised fact 1. Average desired hours per employed individual are negatively correlated to GDP per capita growth rate.

Stylised fact 2. During recession periods, the gap between average desired and actual hours per employed individual widens, primarily due to an increase in desired hours.

The left column of Figure 1 plots average desired hours worked per employed individual on the left axis and GDP per capita growth rate on the right axis. GDP per capita growth rate is a measure of the business cycle comparable across countries. Other measures, for example unemployment rate, can be used in determining a period of a recession in one country over time, however, it is more difficult to determine it cross-country. Figure 5 in Appendix A, shows the comparison of unemployment rate and average desired hours. For example, it is visible that in UK, unemployment rate follows the patterns of the Great Recession - increasing in 2008 and decreasing in 2014; whereas that is not the case in Germany.

During the period observed in the sample, 1998 - 2017, there were two recessions in Europe: the first one at the beginning of 2000s and the Great Recession, starting in 2009. Average desired hours are countercyclical - whenever the GDP growth rate falls, average desired hours increase. Early 2000s recession was relatively smaller than the Great Recession, therefore it is reasonable

to observe that desired hours do not necessarily correspond as much to changes in GDP per capita. This phenomenon could be easily explained by a decrease in actual hours in recessions. However, actual hours worked do not fall significantly during the Great Recession. The right hand side panel of Figure 1 shows that, after 2009, actual hours remain relatively stable or decrease by 1 hour over a few years, at the most. On the other hand, average desired hours increase sharply, therefore widening the gap between actual and desired hours. Therefore, during the Great Recession, underemployment increased primarily due to an increase in desired hours. The fall in actual hours before the Great Recession happened mostly during the economic boom leading up to the Great Recession. This is consistent with findings from Bick et al. (2018), where the authors show that actual hours worked decrease with income on the aggregate and individual level.

There is a number of possible explanations for the desired hours pattern. One is precautionary labour supply, as discussed in Jessen et al. (2018) for Germany, means that in a high income risk situation, individuals would like to work more hours for a given wage rate, to compensate for the future expected income losses. Second is a wealth effect: if individual's assets (housing or financial assets) lost value during recessions, she would likely want to work more hours. Third, income effect could be in place: for lower labour income, individuals would want to work more hours to compensate for the loss. In this paper, I focus on the income effect, due to data limitations (there is no wage or asset information in the EU LFS). Labour income loss can come from many different sources: in recessions part-time work becomes more prevalent (as discussed in Borowczyk-Martins and Lale (2019) for the US and UK), temporary contracts are more common, partners lose jobs so the household income declines, paid overtime work is less common, while unpaid becomes more common. All of these sources of income loss could drive an increase in desired hours for employed individuals during recessions and will be discussed further in Section 6. Additionally, the question in the LFS questionnaire is asked to indicate desired hours, for a corresponding income increase and a given wage rate. Therefore, an increase in desired hours on the aggregate level is likely to be a consequence of the desire to increase earnings.

The rest of the paper briefly discusses the historical background of recessions for each country, identifies the effect of the recession on desired hours (test of the Stylised fact 1) and then identifies the income effect.

Figure 1: Countercyclicity of desired hours and actual hours worked

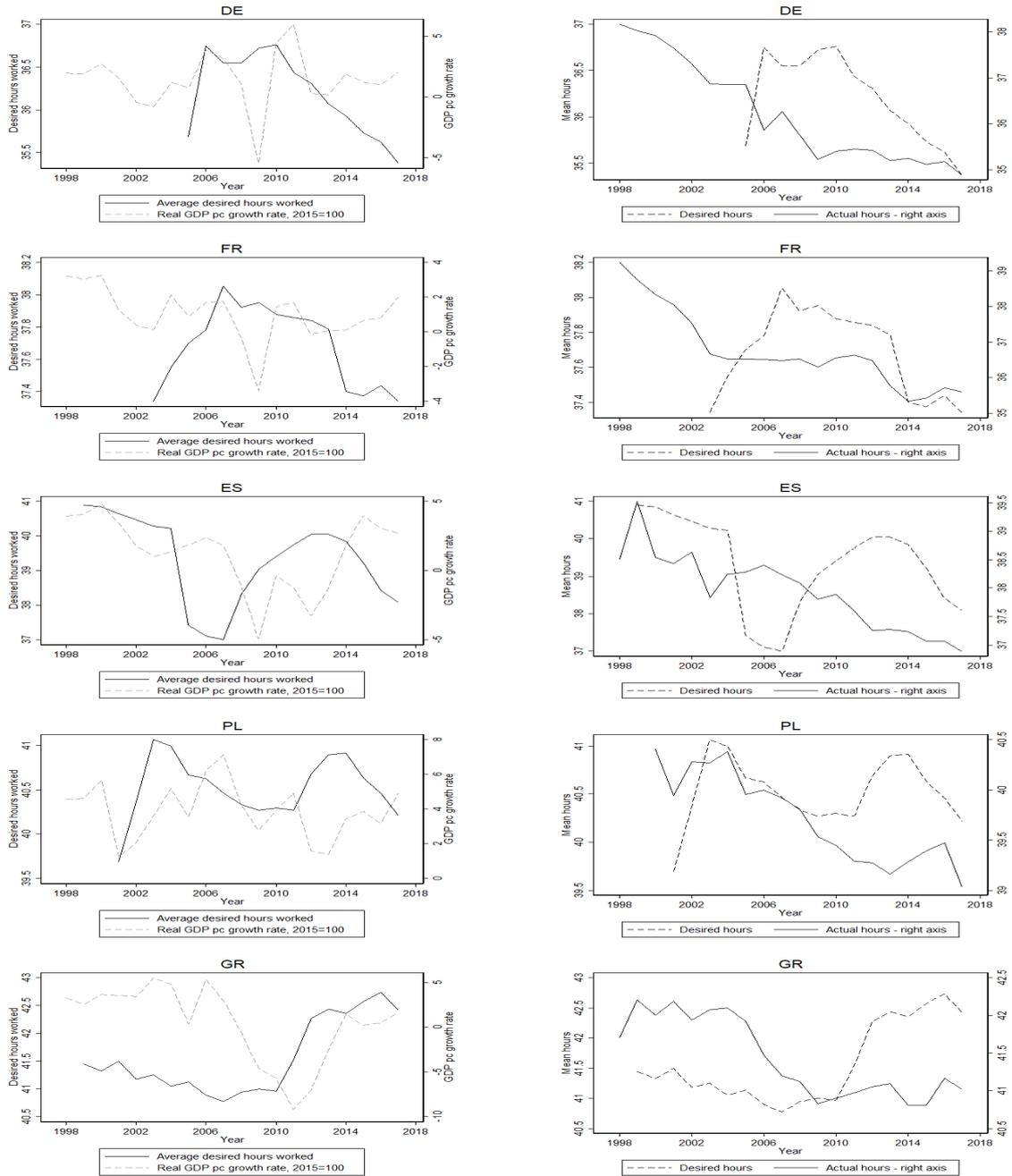


Figure 1: Countercyclicity of desired hours and actual hours worked

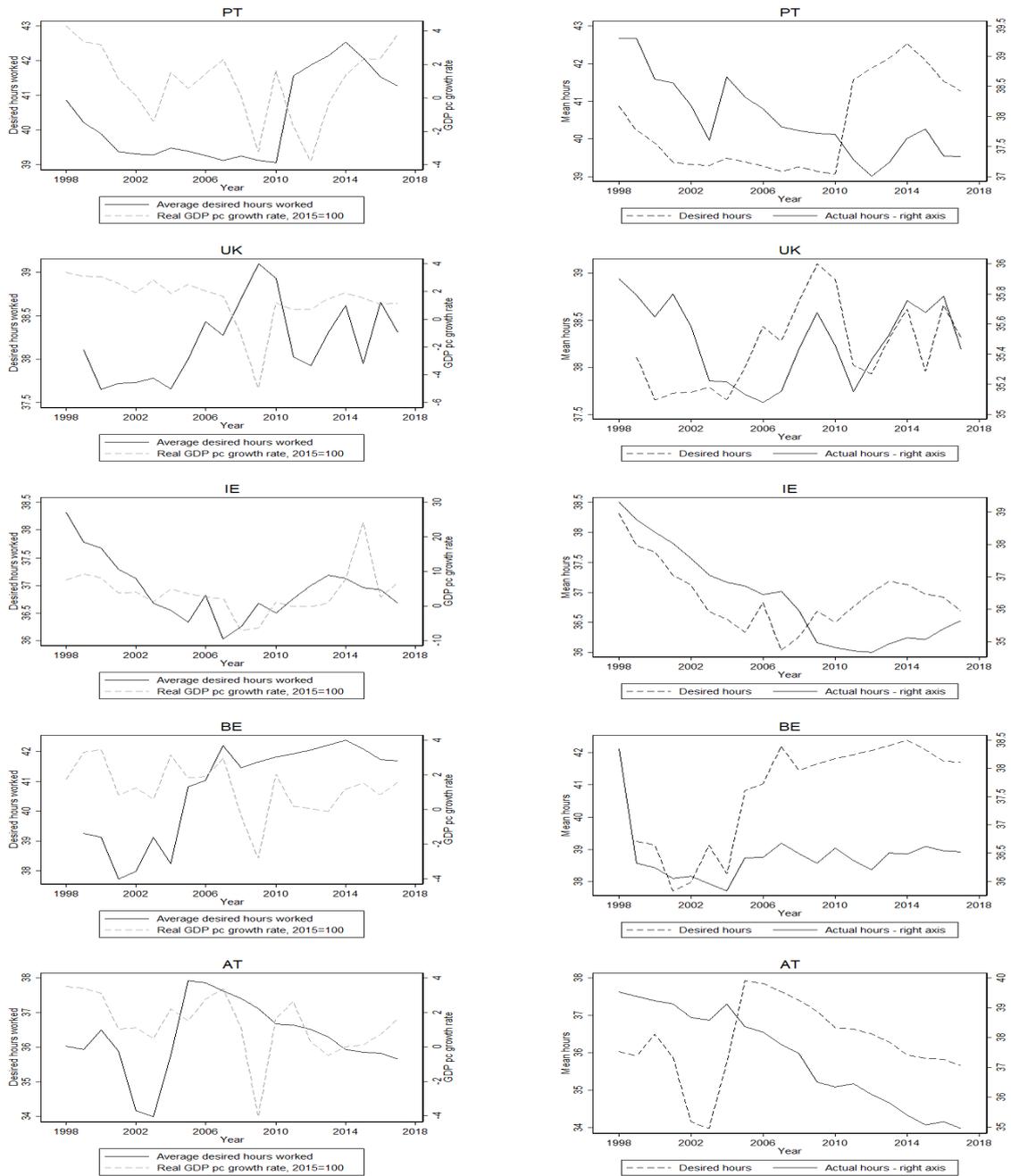
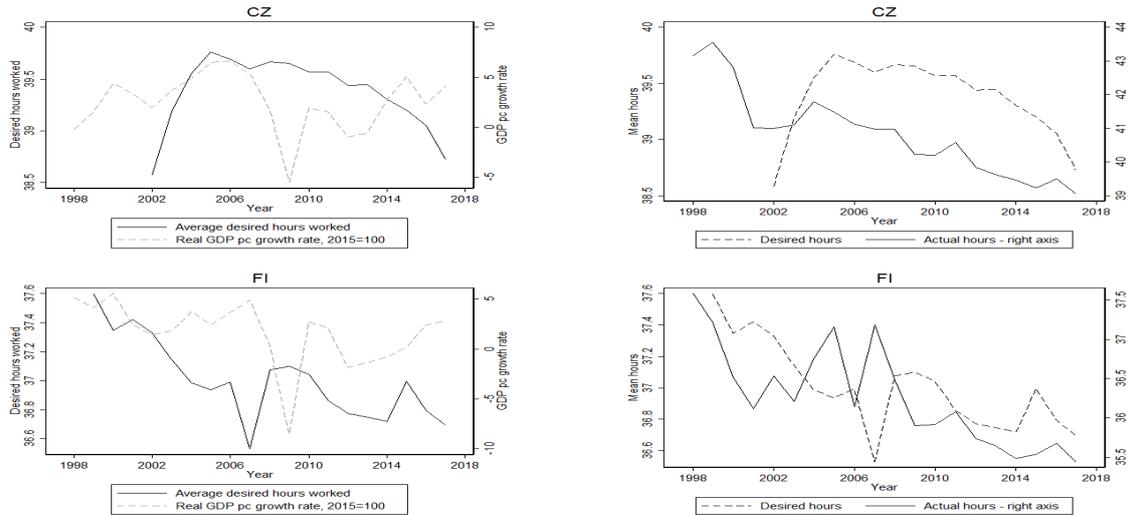


Figure 1: Countercyclicity of desired hours and actual hours worked



Notes: The left column plots average desired hours worked for employed individuals in each country in each time period, with GDP per capita growth rate. The column on the right plots average actual and desired hours worked of employed individuals. Average hours worked are calculated from the EU LFS dataset and GDP per capita is retrieved from Eurostat Database.

4 Historical background

In Section 3, I briefly discuss the existence of two recessions in Europe over the period from 2000 to 2017. In general, the recession at the beginning of 2000s had a much smaller impact on most European economies than the Great Recession and it mostly affected continental Europe. In addition, the Great Recession was a "W-recession", with a brief recovery around 2010, and a consequent dip. We usually measure recessions in terms of negative GDP growth rate; however, in many countries high unemployment rates persisted well after the Great Recession ended in terms of GDP growth rate. Since the two recessions had idiosyncratic effects in European countries, this section outlines country-specific labour market characteristics that could matter in interpretation of desired hours pattern over time and justify the use of unemployment rates in identifying the effect of a recession *within* one country.

Germany is one of the rare countries, where the recession from 2001 to 2005 had a much larger effects on the labour market than the Great Recession, in terms of both unemployment rates and its persistence. German unemployment rate was 10% in 2005, steadily decreasing thereafter, being 6% in 2009 and below 4% in 2017. Burda and Hunt (2011) argue that the labour market reforms from 2003 to 2005 reduced unemployment rates and acted as a break on the rising unemployment in the Great Recession. In terms of desired hours worked, I would expect to see that desired hours are much higher around 2005 than 2009 in Germany, which is confirmed on Figure 1.

Czech Republic was affected by the recession at the beginning of 2000s, when the unemployment rate was close to 9%. However, in the middle of the Great Recession, unemployment rates never surpassed that number and have declined ever since 2013, amounting to 2% in 2019. Figure 1 shows how desired hours start to decrease around 2013 as well.

Similarly, Belgium was affected by the early 2000s recession, where unemployment rates almost reached 9%, which was also true in 2015. Bodart et al. (2016) argue that this is due to the large differences in Belgian regions, with Southern labour markets performing worse. Additionally, real earnings have been steady since 2000. Real disposable income per capita has surged after 2009 to the level of the 2000.

Austrian unemployment rate has been fluctuating around 4% ever since 2000. Employment has slightly increased since 2005, due to increase in part-time work, as noted by Rene (2016). The effect of the early 2000s recession can be seen in the unemployment insurance recipients around 2004, increasing by around 2 percentage points. There were no significant increases until 2013, when it increased by large 10 percentage points. Real wages have been increasing throughout 2000s, never falling below 2000 level.

Prior to the explanation of French recessions, it is important to outline peculiarities of the French labour law, which are important in the desired hours context. In 1998 and 2002 for large and small companies respectively, France re-implemented a 35-hour weekly cap on hours worked Askenazy (2013). In addition, Sarkozy incentivised longer work hours by detaxing overtime hours in 2007, which was then abolished in 2012 by Hollande, due to high unemployment rate and a high budget deficit. Due to these changes which could directly affect individual desired hours, it is difficult to identify the effect of recessions on desired hours in France. However, it seems that unemployment rates were higher after the Great Recession, peaking at 11% in 2014.

In Portugal, unemployment rates soared from below 5% in 2000 to above 15% in 2013. As noted by ILO (2018), Portugal has a long history of common temporary and fixed-term contracts, which became even more common during the Great Recession. Additionally, even after unemployment rates lowered to pre-crisis levels, job quality and wages remained low. Therefore, we can expect that temporary workers could help explain desired hours pattern, even though the breakdown of average desired hours by temporary and permanent work does not show large differences between the two groups.

Spanish labour markets were hit by the Great Recession the hardest in Europe. Spanish unemployment rate soared to above 25% in 2013, from relatively low 10% at the beginning of 2000s. As noted by Teraskaya and Sanz-de Galdeano (2017), temporary work was common among young workers, however the overall rate of temporary work decreased in the wake of the Great Recession. One of the main issues is that real wages decreased after 2010 and have not yet returned to pre-crisis levels. Therefore, desired hours should increase with unemployment.

Alongside Spain, Greece had the second highest unemployment rate in Europe, post-2008, peaking at 25% in 2013. Even in 2017, the unemployment rate is at high 20%. Wages fell due to decentralising collective bargaining from the sector level to individual companies, alongside the fall of the minimum wage purchasing power by almost 25% from 2010 to 2014. Labour market indicators still show the effects of the recession, over 10 years since its beginning (OECD (2017)).

In the UK, there was no visible effect of the early 2000s recession. The Great Recession seemed to have a lower effect than the recessions in the 1980s and 1990s, however it persisted for longer. Unemployment rates peaked at just above 8%, which is lower than even the EU average - 12%, (Coulter (2016)). Real wages have decreased by 1.2% in 2008, one year before the recession affected the rest of European countries. Figure 1 shows that the increase in desired hours coincides with the start of the recession in 2008.

Irish economy suffered from 10 percentage points change in unemployment rates, peaking

in 2012 at around 14%. At the same time, real and nominal wages were decreasing from 2009 to 2011 (Barret and McGuinness (2012)). The Great Recession affected all of the economy, but more so highly skilled individuals (Berscholz and Fitzgerald (2016)) and increased the number of part-time workers, especially under 25. Roughly 40% of the part-time workers worked part-time because they could not find a full-time job (Walsh (2015)). Therefore, I expect to see changes in desired hours worked overall because of the wage decreases, but from part-time workers as well.

Poland is the only country where GDP growth rates never turned negative. Unemployment rates decreased by 10 percentage points from the beginning of 2000s to 2010. Regardless, real wage growth dropped from 6% to 0 in 2012. Employment protection was less, increasing the share of temporary work, which stopped growing only after 2015 (Lewandowski and Magda (2018)). Therefore, regardless of the fact that Poland has not officially suffered a recession, I expect to see increases in desired hours after 2009.

In Finland, unemployment rate increased by over 2 percentage points in just one year, from 2008 to 2009, and continued to rise until 2015, reaching almost 10%. Kyyra and Pesola (2016) note that long-term unemployment and underemployment seem to be of particular concern since the onset of the Great Recession. These concerns are accompanied by non-increasing real earnings since 2010, possibly as a consequence of a highly centralised bargaining system. Additionally, NOKIA used to be an important pillar of the Finnish economy, but has not adjusted to the new market of smartphones. Suni and Vihriala (2016) report that NOKIA's performance contributed to 1/3 of the GDP decline and 1/5 of the reduction of total employment from 2008 to 2014.

5 The effect of recessions on desired hours

This section tests Stylized fact 1 - the effect of recessions on desired hours is positive. A measure of recession should be exogenous, have variation within a country and over time and its marginal effect on desired hours should be comparable across countries. Therefore, I use regional unemployment rates within each country. The regressions are done country by country and not pooled together because recessions were idiosyncratic in Europe, with different labour market institutions at play which could all affect the unemployment rates and bias the estimates.

I first estimate the effects of regional unemployment rates using EU LFS data for all European countries. However, EU LFS does not contain a panel component and the results could potentially be driven by the composition effect - simply that more individuals who would like to work more hours are being surveyed. To address this concern, I estimate the same marginal effect for France using French Labour Force Survey (Enquête emploi en continu - EEC), obtained from the producer Insee through the platform Quetelet. The big advantage of the data sourced from the national producer is the panel component. The results from France confirm the cross-country analysis for other countries.

5.1 Recessions on desired hours - cross-country analysis

To be able to identify the effect of recessions on desired hours: (i) regional unemployment rates should vary within a country and (ii) unemployment rate changes over time should vary between regions. For example, in UK's Northern Ireland, unemployment rate grew by 3 percentage points: from 4.4% in 2008 to 7.4% in 2012, while in East of England it grew by only 0.5 percentage points: from 6.2% in 2008 to 6.7% in 2012. Variation in regional unemployment rates and their changes over time can be found in all countries in the sample⁴.

⁴Regional unemployment rates are available on Eurostat Database, retrieved 11/02/2020.

The effect of recessions on individual desired hours is estimated in the most general specification for each country separately:

$$hours_{irt} = \alpha_0 + \alpha UR_{rt} + \beta' X_{irt} + \mu_r^1 + \mu_t^2 + X_{irt} * \mu_r^1 + \mu_r^1 * \mu_t^2 + \epsilon_{irt} \quad (1)$$

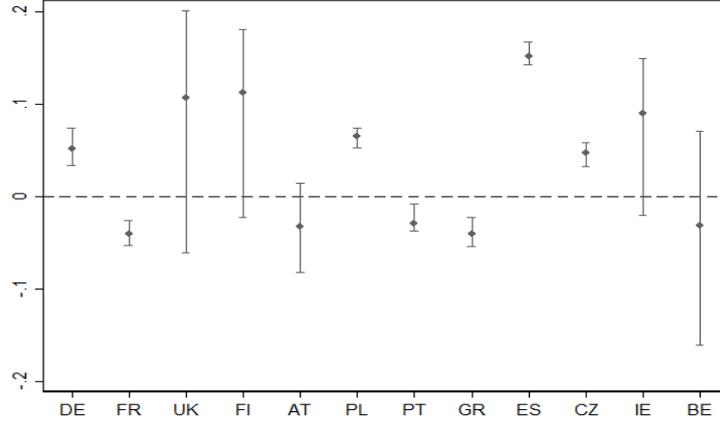
$hours_{irt}$ are desired hours for each individual i in region r in year t . The marginal effect of interest is α as it captures the effect of regional unemployment rate UR_{rt} on individual desired hours. I control for individual characteristics X_{irt} : quadratic age polynomial, education, gender, part-time work, number of employed individuals in the household, sector and occupation dummies, temporary work, urban area dummy. Regional fixed effects μ_r^1 account for between-regional differences, constant over time. Year fixed effects μ_t^2 remove time varying unobservables to desired hours. $\mu_r^1 * \mu_t^2$ remove unobservable trends between regions, like country level institutional changes on the labour market. Interactions between observable characteristics and regional fixed effects account for possible differences between regions in terms of individual labour market preferences. Therefore, the model is identified using the variation in regional unemployment rates UR_{rt} , for a given year. The only possible variation this specification is not capturing are individual fixed effects, potentially capturing time-invariant individual unobservable heterogeneity, like ability. This variation, therefore might affect the *level* of desired hours within a country, but not the marginal effect of the unemployment rate on desired hours *over time*. The next subsection, on the French panel data is estimated controlling for the individual fixed effects and therefore solves this potential source of the bias in the model.

The results are presented in Figure 2 and Table 2, upper panel. Figure 2 shows that regional unemployment rate (UR), *on average, over the whole sample period* has a positive effect on desired hours in half of the countries in the sample. The coefficient ranges from around 0.05 in Germany, Czech Republic and Poland, to 0.15 in Spain. This means that for a 1 percentage point higher unemployment rate in a region, individuals increase their desired hours worked by $0.05 \times 60 \text{ minutes} = 3 \text{ minutes}$ in a reference week (Germany, Czech Republic, Poland) to $0.15 \times 60 \text{ minutes} = 9 \text{ minutes}$, in Spain. On a yearly level, this amounts to 2.6 - 7.8 hours. I find a negative or insignificant effect in France, UK, Austria, Portugal, Greece and Belgium.

The effects from equation 1 are estimated on pooled periods, similar to Lazear et al. (2016), where boom and bust periods are pooled. Therefore these effects are the conservative estimation of the desired hours changes for an increase in the regional unemployment rate⁵.

⁵This is confirmed on the French panel data, where the effect on desired hours during the recession period is positive and statistically significant, even though the average effect for France in this specification is not.

Figure 2: The effect of regional unemployment rate on desired hours



Notes: This figure shows the average marginal effect of regional unemployment rate on desired hours over the available time period for each country. It plots the coefficient α from equation (1) and the corresponding 95% confidence intervals. Dependent variable is desired hours worked. Additional specification of the same equation is presented in Table 2.

To decrease the bias of time fixed effects and estimate the effect of recessions on desired hours, I include a recession dummy variable in the equation 1 from above:

$$hours_{irt} = \alpha_0 + \alpha_1 UR_{rt} + \alpha_2 recession_t + \beta' X_{irt} + \mu_r^1 + \mu_t^2 + X_{irt} * \mu_r^1 + \mu_r^1 * \mu_t^2 + \epsilon_{irt} \quad (2)$$

As before, $hours_{irt}$ are desired hours for each individual i in region r in year t , UR_{rt} is the regional unemployment rate, X_{irt} are individual characteristics: quadratic age polynomial, education, gender, part-time work, number of employed individuals in the household, sector and occupation dummies, temporary work, urban area dummy. μ_r^1 are regional fixed effects and μ_t^2 are time fixed effects. $recession_t$ is equal to 1 if national GDP per capita growth rate is negative and 0 otherwise. α_2 captures the effect of the national level dip in GDP per capita, which was captured by time fixed effects in equation 1.

The results are presented in Table 2, bottom panel. I focus first on the countries where there was no effect of regional unemployment rates on desired hours: France, UK, Austria, Portugal, Greece⁶ and Belgium. In France, recession increases desired hours by 22.5 minutes in a reference week or 19 hours on a yearly level. Even larger effects are found in Austria and Portugal. In countries where higher unemployment rates increased desired hours, the magnitude of the effect increases, confirming that the previous specification underestimated the effect.

The empirical model above is identified with regional unemployment rates. It is fairly straightforward to see that using regional unemployment rates, the model does not suffer from reverse causality, as individual desired hours will not affect the unemployment rate. Omitted variable bias can come from anything that would affect desired hours and vary with the regional unemployment rate. On the country level, vacancy rates could have a negative effect on desired

⁶In Greece, the sign of the unemployment rate changed, compared to the previous specification, pointing to multicollinearity, which is confirmed by a very high VIF.

Table 2: The effect of recessions on desired hours worked
Dependent variable: desired hours

	DE	FR	UK	FI	AT	PL	PT	GR	ES	CZ	IE	BE
Regional UR	0.0523*** (0.00985)	-0.0401*** (0.00729)	0.107 (0.0668)	0.112** (0.0427)	-0.0326 (0.0250)	0.0656*** (0.00482)	-0.0287** (0.00888)	-0.0400*** (0.00799)	0.152*** (0.00745)	0.0473*** (0.00661)	0.0896* (0.0375)	-0.0316 (0.0768)
<i>N</i>	1427331	1942849	77798	189835	1187712	1632316	999702	1027185	523613	839814	804519	53210
adj. <i>R</i> ²	0.591	0.323	0.467	0.352	0.470	0.306	0.403	0.274	0.275	0.341	0.534	0.331
Regional UR	0.241*** (0.0576)	-0.505 (0.412)	-0.873 (0.920)	1.197 (0.674)	-0.201 (0.151)	1.975*** (0.288)	-0.339*** (0.0592)	1.940*** (0.239)	0.425*** (0.0686)	0.201*** (0.0441)	0.410* (0.194)	0.680 (1.540)
Recession = 1	-4.893*** (0.424)	0.375 (0.222)	0.0629 (1.131)	5.236 (2.807)	1.595*** (0.211)	0 (0)	6.546*** (0.748)	-29.96*** (4.078)	0.362 (0.603)	0.928*** (0.234)	-3.263 (1.856)	0.582 (4.670)
<i>N</i>	1427331	1942849	77798	189835	1187712	1632316	999702	1027185	523613	839814	804519	53210
adj. <i>R</i> ²	0.591	0.323	0.467	0.352	0.470	0.308	0.404	0.276	0.280	0.342	0.534	0.334

Notes: This table presents the results of equations (1) in the upper panel and (2) in the bottom panel. Bootstrap standard errors are in the brackets. The sample is a repeated cross-section of working-age, employed individuals who answered the question on desired hours. Regressions include individual characteristics (quadratic age polynomial, education dummies, gender, part-time work, temporary contract, population density, occupation and sector dummies), region and time fixed effects and the interactions between them. Interacting the recession dummy with the regional unemployment rate yields similar results, apart from UK where the interaction coefficient is 1.2 and statistically significant. I do not show the results here because of high collinearity that the interaction imposes in the regression.

hours, and negatively correlate with unemployment rates. Changes in vacancy rates over time will be removed by time fixed effects. On the regional level, labour pooling could have an effect on desired hours. For example, if one region specialises in a sector where people would like to work more hours, which is usually the case in IT or start-up industries, this would cause endogeneity of my estimates. Any differences between regions are being removed by region fixed effects. If there are any institutional changes on the regional level, will be removed by the interaction between time and region fixed effects. The only variation that I am not able to capture with the existing specifications is individual unobservable variation, constant over time. This variation might affect the level of desired hours within a country, however not the marginal effect of the unemployment rate on desired hours over time. Therefore I estimate the same specification as in equation 1 on a panel of individuals in France in the next section.

5.2 Panel analysis of the effect of the Great Recession on desired hours in France

This section replicates the results from the previous subsection 5.1, on a panel of individuals, to solve potential issue of endogeneity and composition effect discussed above. I utilise panel data from the French Labour Force Survey (Enquête emploi en continu - EEC), obtained from the producer Insee through the platform Quetelet. Data is published on a quarterly level, and consists of a rolling panel of individuals. Individuals are interviewed for 6 waves. Each quarter, 1/6th of individuals from the previous wave is replaced by new individuals.

The goal of this section is to estimate the effect of the Great Recession on desired hours using a panel of individuals. The Great Recession in France started in the second quarter of 2008. I use a period of 6 quarters, from 2007q4 to 2009q1, covering the time just before the onset of the recession and its beginning. The regression will estimate the average effect of the change in regional unemployment rate on desired hour, over that period. As a comparison of the effect, I add 3 additional time periods: before the Great Recession 2006q1 - 2007q2, during the recession and a small recovery 2009q4 - 2011q1, and after the recession 2015q1 - 2016q2. I expect to see a positive and significant effect of the recession in the period of interest (2007q4 - 2009q1), but a negative and/or insignificant effect in other periods.

Summary statistics of the panel individuals included in the empirical specification is presented in Table 3. There is over a 1000 individuals in all 4 samples.

Table 3: Descriptive statistics on desired hours worked for French panel data

	2006q1 - 2007q2	2007q4 - 2009q1	2009q4 - 2011q1	2015q1 - 2016q2
Average desired hours	39.6	39.1	39	38.6
SD desired hours	8.5	10.2	9.3	9.6
Average actual hours	35	34.3	34.1	32.9
SD actual hours	12.2	12.2	12.2	13.2
N groups	1332	1254	1634	1790
N	7992	7524	9804	10740

Notes: The four samples consist of employed individuals over the 6 waves they were interviewed in. They answered the question on desired hours at least in two waves. Average desired and actual hours are calculated by employed individuals.

Some individuals do not answer the question on desired hours in all waves, hence the lower number of individuals in the regression results. It is interesting to note that desired hours are consistently higher than actual hours, probably due to the national cap on hours worked in France. Actual hours decline in the post-recession sample from 2015, consistent with Bick et al. (2018).

Similar to equation 1, I use the four samples from Table 3 to estimate the effect of the Great Recession on labour supply:

$$hours_{irt} = \alpha_0 + \beta_0 UR_{rt} + \beta' X_{irt} + \alpha_i + \mu_r^1 + \mu_t^2 + X_{irt} * \mu_r^1 + \mu_r^1 * \mu_t^2 + \epsilon_{irt} \quad (3)$$

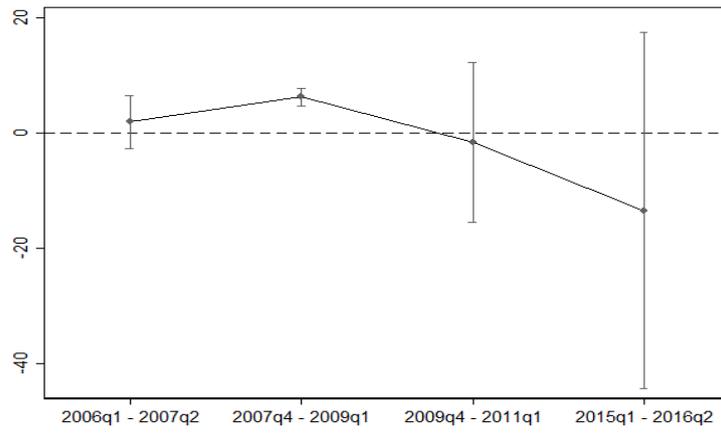
$hours_{irt}$ are desired hours for each individual i in region r in quarter t . β_0 is the marginal effect of regional unemployment rate UR_{rt} on individual desired hours. X_{irt} is a vector of individual characteristics: quadratic age polynomial, education, gender, part-time work, 3-digit ISCO occupation dummies, type of contract and population density dummies. Regional fixed effects μ_r^1 account for between-regional differences, constant over time. Time fixed effects μ_t^2 remove time varying unobservables to desired hours. $\mu_r^1 * \mu_t^2$ remove unobservable trends between regions, like country level institutional changes on the labour market. Interactions between observable characteristics and regional fixed effects account for possible differences between regions in terms of individual labour market preferences. α_i are individual fixed effects, which capture any potential unobservable time-invariant characteristics. Therefore, the model is identified using the variation in regional unemployment rates UR_{rt} , for a given year.

Equation 3 is estimated using the random effects model⁷, because the variation in desired hours comes from both within (over time) and between individuals. Figure 3 shows the coefficient β_0 from equation 3 in all 4 time periods. The period of interest is 2007q4 to 2009q1, because it covers the time before the onset of the recession and its beginning in 2008. The average increase in desired hours as a consequence of 1 percentage point higher unemployment rate is statistically significant and is 1.6 hours in the reference week. There are two interesting things to note about this finding. First is the comparison of this effect to the result in Table 2, where the effect of the recession *decreases* average desired hours. This suggests that the average effect over the entire period (2003-2017) is biased downwards and that the true effect of the recession on desired hours is larger. This likely explains the differences in magnitudes of the effect for other countries as well. Second, the downward bias is further confirmed by looking at the effects in other periods in Figure 3, which are either statistically insignificant and/or negative.

The choice of random effects as a preferred specification is easily justified by poor estimates produced by OLS and FE models in Table 4. OLS is biased in the opposite direction of the RE estimates: in the period of interest (2007 - 2009), OLS is much lower and statistically insignificant. However, this is comparable to the estimates from the EU LFS data, where the effect is of similar size and also statistically insignificant. The bias comes from the fact that OLS cannot pick up the variation in both between and within variation in desired hours. Furthermore, FE estimates have a very low R^2 , due to low within variation, coming from variables that do not vary over time, for example gender and occupation. This is confirmed by a very high fraction of variance coming from the time invariant fixed effect - ρ in the table. There is also variation in desired hours between individuals, which is not captured by FE model. Hausman test confirms the choice of RE over FE model.

⁷Table 4 shows a comparison of the random effects model to the fixed effects and OLS estimators.

Figure 3: The effect of unemployment on desired hours in France



Notes: This figure shows marginal effects of regional unemployment rate on desired hours from 4 regressions in the labelled time periods. It plots the coefficient β_0 from equation (3) and the corresponding 95% confidence intervals. Dependent variable is desired hours worked. Additional specifications of the same equation is presented in Table 4.

Table 4: The effect of recessions on desired hours worked in France
 Dependent variable: desired hours

	2006q1-2007q2			2007q4-2009q1			2009q4-2011q1			2015q1-2016q2		
	RE	OLS	FE	RE	OLS	FE	RE	OLS	FE	RE	OLS	FE
Regional UR	1.894 (2.328)	-0.570 (3.509)	2.568 (2.232)	6.209*** (0.791)	0.503 (888794.6)	-140.8 (210.0)	-1.675 (7.087)	4.802 (7.634)	-4.928 (7.058)	-13.51 (15.79)	-8.906 (17.53)	-18.61 (18.36)
N	2847	2847	2847	2479	2479	2479	3082	3082	3082	3582	3582	3582
N of groups	1016		1016	961		961	1235		1235	1529		1529
Adjusted R2		0.331	0.0482		0.316	0.0577		0.322	0.129		0.335	0.0755
Overall R2	0.367		0.00131	0.365		0.00106	0.346		0.000630	0.387		0.00863
Rho	0.644		0.950	0.632		1.000	0.709		0.962	0.676		0.978

Notes: Standard errors in the brackets, clustered on the individual level. The sample is a panel of individuals interviewed and employed in 6 consecutive waves, who answered the question about desired hours in at least two waves. Regressions include individual characteristics (quadratic age polynomial, education dummies, gender, part-time work, type of contract, 3-digit ISCO occupation dummies and population density), region and time fixed effects and the interactions between them.

6 Desired hours and the income effect

This section discusses income effect as a possible driver of desired hours increases during recessions. The first subsection presents descriptive statistics of possible income effect mechanisms (part-time and temporary work, overtime hours and number of employed individuals in the household). The second part of this section tests the income effect hypothesis in an empirical model.

6.1 Income effect mechanisms

European LFS, instead of wage information, contains individual income decile information from 2009. The variable consists of imputed values from 1 to 10, based on the individual labour income and national income distribution. Figure 6 in Appendix B shows country-level average desired hours by each decile⁸. Without detailed income information, changes in desired hours by income deciles could be driven by the composition effect - more individuals surveyed at the bottom of the distribution. The right-hand side panel of Figure 6 shows the share of individuals in each income decile, where the shares change in a similar direction over time in most countries. Therefore, it is informative to observe country-level average desired hours by each decile. In most countries, desired hours at the bottom are the lowest, while the top decile has the highest desired hours. In some countries it is visible, even on the country level, that bottom on the income distribution changes desired hours more than the rest of the distribution (Poland, Ireland, Portugal, Greece). In Spain, median earners desire the highest hours worked, but the top of the distribution increases their desired hours the most after 2009. One possible explanation could be that they have lost the most income in absolute terms and that income elasticities are higher for the top of the distribution. If this is confounded with wealth losses (housing prices, financial wealth), the richest individuals would increase desired hours the most. I cannot disentangle these effects due to the lack of information on wealth, however income and wealth distributions in European countries positively correlated (HFCN (2016)).

Borowczyk-Martins and Lale (2019) find that labour demand adjusted on the intensive margin during the Great Recession in the US and UK, rather than on the extensive margin. If this holds for other countries except the US and UK, new part-time workers would probably desire to work their previous full-time hours. In that case, my first stylized fact - that desired hours are countercyclical - could be driven by part-time workers. Figure 7 in Appendix B shows average desired hours for part-time and full-time workers over time. Part-time workers, rather than full-time, increase desired hours in only a few countries during recession times: UK, Ireland and Sweden. This is consistent with the findings from Borowczyk-Martins and Lale (2019). In the remaining 10 countries, both full-time and part-time workers increase desired hours simultaneously. In Spain during the Great Recession and in Austria at the beginning of 2000s, full-time workers are the ones who primarily increase their desired hours worked. These descriptive statistics go against the literature findings and predictions of an income effect theory.

On the other hand, paid and unpaid overtime hours could correlate with desired hours in different directions. Unpaid overtime hours often increase during recession periods, due to labour demand adjustments and firms' financial constraints. This could be exacerbated if the legislative mandates higher wage rates for overtime work, but does not regulate unpaid overtime hours. Individuals working unpaid overtime hours would potentially like to work more hours, to receive compensation for their unpaid hours. On the other hand, paid overtime hours mostly require a higher wage rate in European countries. If there is less paid overtime work available during recession periods, individuals would desire more hours worked, as they otherwise lose

⁸I use this variable in Section 6.2, on the regional level, which offers more variation within each country.

earnings from overtime hours. On the other hand, if overtime hours are necessary due to labour demand adjustments, paid overtime hours could be higher during recessions and correlate with desired hours ambiguously. To observe these mechanisms between overtime and desired hours, I plot average desired hours with average paid and unpaid overtime hours on Figure 8, Appendix B. Since we can expect different relationships between overtime and desired hours, I group countries based on Figure 8: i) paid and unpaid overtime hours negatively correlate with desired hours (Germany, France, Belgium, Greece); ii) unpaid overtime and desired hours positively correlate (UK, Spain); iii) paid overtime negatively correlates with desired hours (Portugal); iv) paid and unpaid overtime hours positively correlate with desired hours (Ireland, Poland, Austria, Finland). Correlations in groups ii) and iii) could indicate an unambiguous income effect. In most countries however, the figure suggests an ambiguous relationship between overtime and desired hours. Due to small shares of individuals in each country working overtime hours, I will not discuss the relationship between overtime and desired hours further.

Temporary contracts were on the rise in European countries during the Great Recession. For employees on temporary contracts, the future is uncertain. It is possible that they would like to work more hours now out of precautionary reasons. Figures 9, Appendix B show that this is true for Greece, Ireland, Austria and Germany after the early 2000s recession. Spanish temporary workers desire more hours than permanent, however permanent increase their desired hours more at the onset of the Great Recession. In UK, Czech Republic and France, the opposite is suggested: temporary workers react during the recession more, however the level of desired hours is lower than permanent workers' hours. In Poland and Portugal, both permanent and temporary workers increase desired hours. This suggests that there is a lot of heterogeneity cross-country, because temporary work regulation depends on the country-specific employment protection legislation, similar to overtime work discussed in the previous paragraph.

Individuals could also target household level incomes. In a scenario where an individual's partner loses a job, she could increase desired hours to compensate for her partner's lost income. LFS does not collect information on partner's labour status. However, variable *hhnbwork* counts the number of individuals working in the household. Average desired hours by the number of working individuals in the household move together and there are no changes around the recession period that would suggest otherwise (Figure 10). Desired hours by age, educational levels and gender, even though interesting, do not show any pattern relevant for this discussion.

6.2 Desired hours and the income effect during the Great Recession

The previous section discusses that a positive effect of recessions on desired hours holds in most countries from the sample. This section aims to discuss the income effect: do poorer individuals in high unemployment areas and years, have higher marginal effect on desired hours worked? I use income decile information, for the available period (2009 - 2017) and include income decile dummies, alongside interaction terms with the regional unemployment rate. Regression 1 can be modified in the following way:

$$hours_{irt} = \alpha_0 + \alpha UR_{rt} + \gamma' UR_{rt} * decile_{irt} + \beta' X_{irt} + \mu_r^1 + \mu_t^2 + \mu_r^1 * \mu_t^2 + X_{irt} * \mu_r^1 + decile_{irt} * \mu_r^1 + \epsilon_{irt} \quad (4)$$

Income effect is captured by marginal effects of the interaction terms $UR_{rt} * decile_{irt}$ between income deciles and regional unemployment rates. I add the interaction between income deciles and region fixed effects, $decile_{irt} * \mu_r^1$ to remove the differences between regions and income deciles (for example, if richer individuals cluster in one region, which could be driven by sector

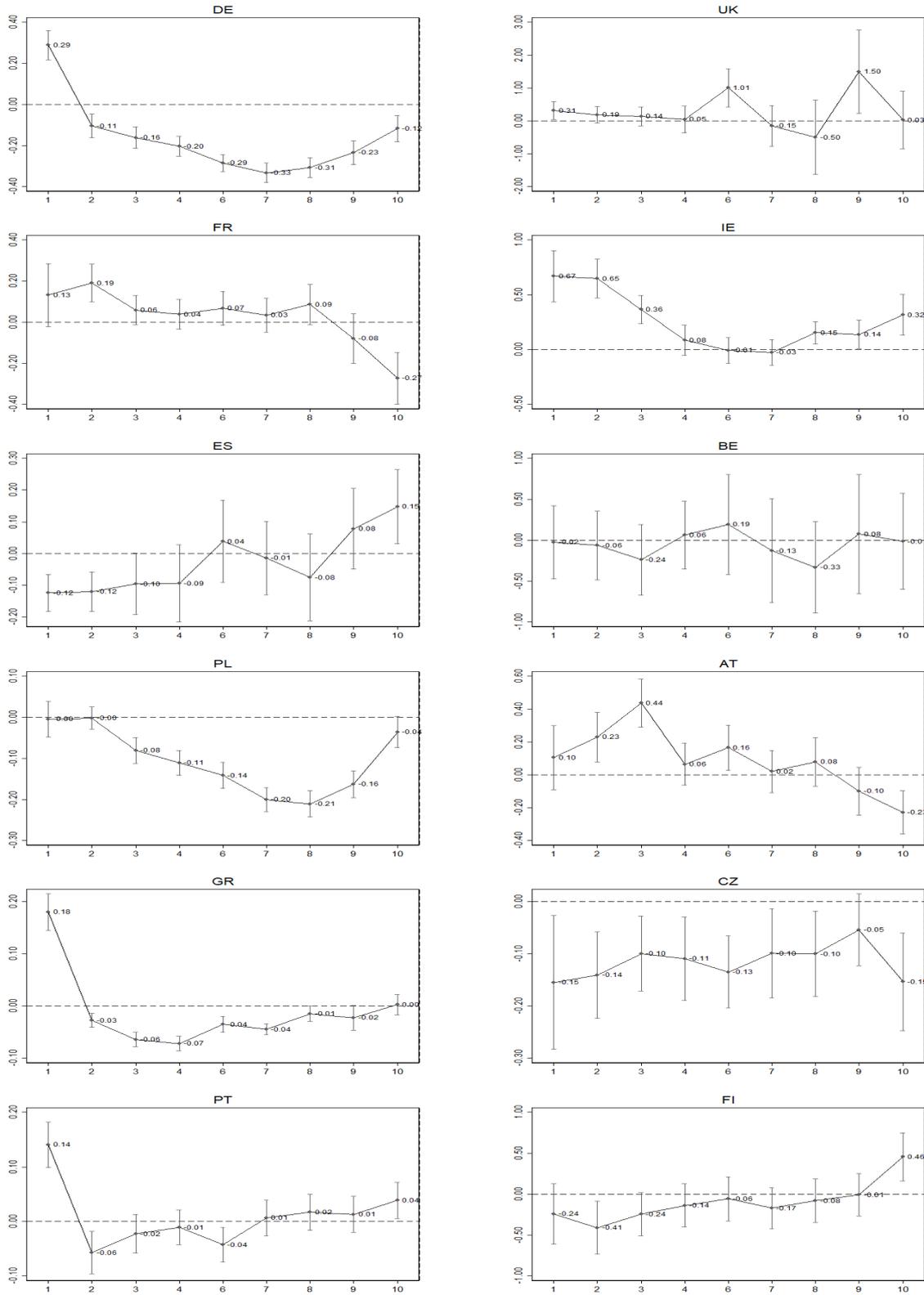
activity).

Figure 4 presents key coefficients from regression 4, particularly the interaction terms between income decile and regional unemployment rates. Decile 5 is left out, so all the coefficients should be interpreted compared to the median. In most countries, the poorer income deciles increase their desired hours for an increase in the unemployment rate. This is now also true for countries in which the average effect of higher unemployment does not increase desired hours. In France, Portugal and Greece, higher unemployment rate significantly increases desired hours, for the first decile; in Austria this holds for the second and third decile. The income effect does not seem to hold in Finland - an unemployment rate increase does not significantly affect desired hours at the bottom of the distribution, but for the tenth decile - the richest individuals in Finland. The same is true in Spain. Ireland is an exception, as both tails of the income distribution seem to react to higher unemployment rates by increasing desired hours.

Magnitudes on the income decile level are much higher than the average effect discussed in the previous section. In the first income decile, marginal effects range from 0.132 in France to 0.67 in Ireland, translating to 8 - 40 minutes in the reference week or 6.8 - 36.4 hours on a yearly level. In Ireland, the magnitude of the effect means that the poorest individuals would like to, on average, work an entire week more per year. It is likely that the effect from income deciles is driven by other mechanisms of the income effect, discussed in Section 6 - part-time and temporary work.

In order to capture the effect of part-time and temporary work in a recession, I include interaction terms between part-time dummy and regional unemployment rates and temporary work and regional unemployment rates in equation 4. The results are presented in 6. Part-time workers would like to work more hours, for a higher unemployment rate in half of the sample: France, Austria, Poland, Greece, Czech Republic and Ireland. Ireland is one of the countries where this results was suggested even by the descriptive statistics from Figure 7. In Portugal temporary workers want to work more hours since Portugal has a long history of temporary work and one of the highest shares of temporary employees in Europe (discussed in Section 4). As in the previous specification, which included only the income deciles, in Germany, UK and Finland, adding part-time and temporary work did not change the effects I find in the previous specification. Spain is the exception, as the income effect does not seem to explain the countercyclicality of desired hours. On the contrary, including additional interaction terms to the specification, increased the coefficient on regional unemployment rates and it now translates to almost 10 hours more on a yearly level, for a higher unemployment rate.

Figure 4: Income effect and desired hours worked



Notes: This figure plots the coefficient γ - the interaction between regional unemployment rate and each income decile. To calculate the total effect for each income decile, regional unemployment rate and income decile dummy coefficients are presented in Table 5. Bootstrap standard errors are in the brackets. The sample is pooled and consists of working-age, employed individuals who answered the question on desired hours. Regressions include individual characteristics (quadratic age polynomial, education dummies, gender, part-time work, temporary contract, population density, occupation and sector dummies), region and time fixed effects and the interactions between them.

Table 5: Income effect and desired hours worked
Dependent variable: desired hours

	DE	FR	UK	FI	AT	PL	PT	GR	ES	CZ	IE	BE
Regional UR	0.178*** (0.0200)	-0.0185 (0.0115)	-0.121 (0.158)	0.145 (0.101)	-0.0288 (0.0529)	0.129*** (0.0113)	-0.0422** (0.0148)	-0.00342 (0.0114)	0.106** (0.0378)	0.0894*** (0.0238)	-0.0986 (0.0861)	-0.165 (0.197)
Decile1	-6.205*** (0.310)	-2.631* (1.218)	-6.511*** (1.089)	0.307 (1.901)	-6.711*** (0.377)	-0.204 (0.230)	0.923** (0.344)	-0.715 (0.461)	2.842** (1.026)	-0.905 (0.631)	-14.53*** (1.691)	-1.747 (2.175)
Decile2	-1.123*** (0.220)	-0.307 (1.289)	-0.576 (1.170)	4.092* (1.672)	-1.589*** (0.279)	-0.0470 (0.164)	0.00360 (0.330)	0.646** (0.212)	2.850* (1.113)	-0.354 (0.427)	-10.39*** (1.285)	-0.338 (2.173)
Decile3	-0.719*** (0.181)	-1.417* (0.552)	1.372 (1.436)	1.754 (1.354)	-0.996*** (0.260)	0.568*** (0.163)	-0.362 (0.272)	-0.0517 (0.186)	2.451 (1.593)	-0.738 (0.384)	-5.476*** (0.927)	1.429 (2.320)
Decile4	-0.357* (0.168)	-0.779 (0.444)	1.110 (1.534)	0.0847 (1.322)	0.178 (0.236)	1.045*** (0.166)	-0.455* (0.218)	-0.205 (0.169)	2.653 (2.137)	-0.631 (0.406)	-1.486 (0.996)	-1.476 (2.275)
Decile6	-0.175 (0.159)	0.635 (0.720)	0.676 (4.002)	-0.477 (1.408)	-1.230*** (0.246)	0.787*** (0.141)	-0.409 (0.225)	-1.475*** (0.181)	-2.601 (1.912)	0.0110 (0.348)	-0.129 (0.845)	-3.726 (3.117)
Decile7	0.00715 (0.175)	-1.426* (0.614)	1.976 (3.150)	0.402 (1.287)	-0.995*** (0.238)	1.042*** (0.141)	-1.272*** (0.239)	-1.916*** (0.123)	-3.743* (1.907)	-0.503 (0.431)	-0.341 (0.828)	1.733 (3.303)
Decile8	-0.370 (0.200)	-2.575** (0.867)	4.669 (4.169)	-0.469 (1.361)	-1.602*** (0.265)	1.303*** (0.195)	-1.316*** (0.218)	-2.837*** (0.166)	1.054 (2.733)	-0.328 (0.392)	-2.812*** (0.721)	3.242 (3.182)
Decile9	-0.812*** (0.220)	-0.646 (1.036)	-6.685 (5.732)	-1.206 (1.349)	-0.831** (0.272)	0.692*** (0.160)	-1.281*** (0.262)	-2.186*** (0.303)	-6.523** (2.280)	-0.587 (0.369)	-2.520** (0.902)	-0.663 (3.906)
Decile10	-0.743* (0.308)	4.416** (1.557)	5.411 (6.722)	-4.689** (1.506)	1.014*** (0.223)	0.488** (0.155)	-1.140*** (0.295)	-0.417 (0.310)	-10.60*** (2.710)	0.254 (0.459)	-3.546** (1.299)	3.315 (3.409)
<i>N</i>	1387009	1415503	29179	109215	791533	1231532	593371	373607	60083	330701	268384	34226
adj. R^2	0.616	0.330	0.443	0.392	0.498	0.305	0.380	0.278	0.203	0.405	0.494	0.404

Notes: This table presents the coefficients for regional unemployment rate and income decile dummies from equation (4). These coefficients can be used with coefficients from Figure 4 to calculate the total effect of recessions for each income decile. Bootstrap standard errors are in the brackets. The sample is pooled and consists of working-age, employed individuals who answered the question on desired hours. Regressions include individual characteristics (quadratic age polynomial, education dummies, gender, part-time work, temporary contract, population density, occupation and sector dummies), region and time fixed effects and the interactions between them.

Table 6: The effect of recessions on desired hours worked - part-time and temporary workers
Dependent variable: desired hours

	DE	FR	UK	FI	AT	PL	PT	GR	ES	CZ	IE	BE
Regional UR	0.0382*** (0.0111)	-0.0374*** (0.0105)	0.172 (0.180)	0.106 (0.0662)	-0.143*** (0.0334)	0.0640*** (0.0102)	-0.0446*** (0.0118)	-0.0380*** (0.0106)	0.180*** (0.0318)	0.0243 (0.0215)	-0.129 (0.0950)	-0.171 (0.104)
Part time * UR	-0.0436* (0.0212)	0.196*** (0.0232)	-0.255** (0.0960)	-0.0593 (0.146)	0.627*** (0.0383)	0.133*** (0.0190)	-0.184*** (0.0153)	0.327*** (0.0115)	-0.168*** (0.0167)	0.270*** (0.0458)	0.395*** (0.0366)	-0.110 (0.105)
Temporary * UR	0.129*** (0.0199)	-0.0735** (0.0224)	0.0622 (0.135)	-0.118 (0.126)	0.0804 (0.0655)	0.0314*** (0.00681)	0.160*** (0.0113)	-0.00738 (0.00825)	-0.102*** (0.0172)	0.0346 (0.0266)	-0.00291 (0.0521)	0.0841 (0.109)
PT = 1	-13.22*** (0.200)	-11.01*** (0.484)	-8.698*** (1.045)	-12.60*** (1.430)	-18.29*** (0.145)	-14.40*** (0.204)	-14.97*** (0.270)	-15.72*** (0.283)	1.629** (0.570)	-15.40*** (0.441)	-19.28*** (0.508)	-6.122*** (1.290)
Temporary = 1	0.212 (0.166)	2.126*** (0.482)	-1.252 (1.212)	1.736 (1.233)	1.890*** (0.240)	0.525*** (0.0893)	-1.288*** (0.158)	0.340 (0.179)	3.342*** (0.604)	-0.451 (0.259)	-0.203 (0.747)	-0.956 (1.149)
<i>N</i>	1387009	1415503	29179	109215	791533	1231532	593371	373607	60083	330701	268384	34226
adj. <i>R</i> ²	0.616	0.330	0.442	0.392	0.498	0.305	0.380	0.280	0.204	0.405	0.494	0.405

Notes: This table shows the the effect of unemployment rate on desired hours for part-time and temporary workers. Bootstrapped standard errors in parentheses. Dependent variable is desired hours worked. The sample is pooled and consists of working-age, employed individuals who answered the question on desired hours. Regressions include individual characteristics (quadratic age polynomial, education dummies, gender, part-time work, temporary contract, population density, occupation and sector dummies, income decile dummies), region and time fixed effects and the interactions between them.

Similar endogeneity discussion to the one in Section 5.1 can be added here. For the sake of brevity, there are only a few notes that should be added here. On the individual level, wealth effect could explain desired hours: if rich individuals' wealth lost value during recessions (for example financial wealth or housing), they would like to work more during recessions. According to HFCN (2016), income and wealth inequality are highly correlated in Europe. Therefore, by including income deciles in equation 4, I approximate the wealth effect on desired hours. The only country where the richest individuals desire more hours is Finland. However, income deciles are not able to estimate the wealth effect, and due to the lack of wealth information, any changes on the individual level over time are removed by time fixed-effects. The same is true for changes in household level incomes as well (for example, if a spouse or a partner lost their job).

7 Discussion and conclusion

In this paper, I show that desired hours worked fall in the boom periods and increase in the recession times, in 12 European countries. Using regional variation in unemployment rates and idiosyncratic changes of regional unemployment rates over time, I identify the effect of the recession on desired hours worked, using a repeated cross-section of individuals using EU LFS panel data. The magnitude of the effect is quite large on the yearly level, varying from 2.6 hours in Germany, Czech Republic and Poland, to almost 8 hours in Spain. These results are biased because of the possible composition effect and they represent an average effect over the entire period of booms and busts. This drawback is circumvented by using a panel of individuals in French LFS. The results confirm that desired hours increase at the recession beginning (2007q4 - 2009q1), while the effect is negative and insignificant in other periods (before and after the Great Recession). This finding supports the idea that OLS results on all countries using EU LFS are biased down and therefore offer a conservative estimate of the effect of recessions on labour supply (desired hours).

Out of several possible explanations of this pattern, I focus on the income effect: poorer individuals or individuals could desire more hours during recessions. This is true in all countries, with even larger effects on desired hours, ranging from 6.8 hours on a yearly level in France to 36.4 hours in Ireland. An exploration of potential mechanism of the income effect confirm the income effect in countries where part-time and temporary work was a common adjustment to the recession. In Ireland, part-time workers account for almost half of the effect in the bottom part of the income distribution. Similarly, in Portugal, where temporary work is among the highest in Europe, temporary workers desire 10 minutes more in the reference week or 8 hours more on a yearly level, for a higher unemployment rate.

There are two exceptions to the income effect finding. In Spain, adding part-time and temporary workers increases the average effect of regional unemployment rates on desired hours to almost 10 hours on a yearly level. The second exception is Finland, where the richest decile increases desired hours by 22 hours per year. This could possibly be due to changes in non-labour income, which is left to be investigated in future work. Ideally, income effect of the labour supply should be shown using a reliable tax-administrative income information. Survey, self-reported incomes suffer from substantial measurement error. I hope this opens a path for new and exciting future work using LFS desired hours worked variable, merged with reliable income sources.

There are several implications of the findings presented in this paper. Desired hours measure true preferences on the labour market, because they are not constrained by the labour demand, as actual hours are. This implies that preferences change over the business cycle, in particular, with the unemployment rate. Even though the business cycle literature assumes that

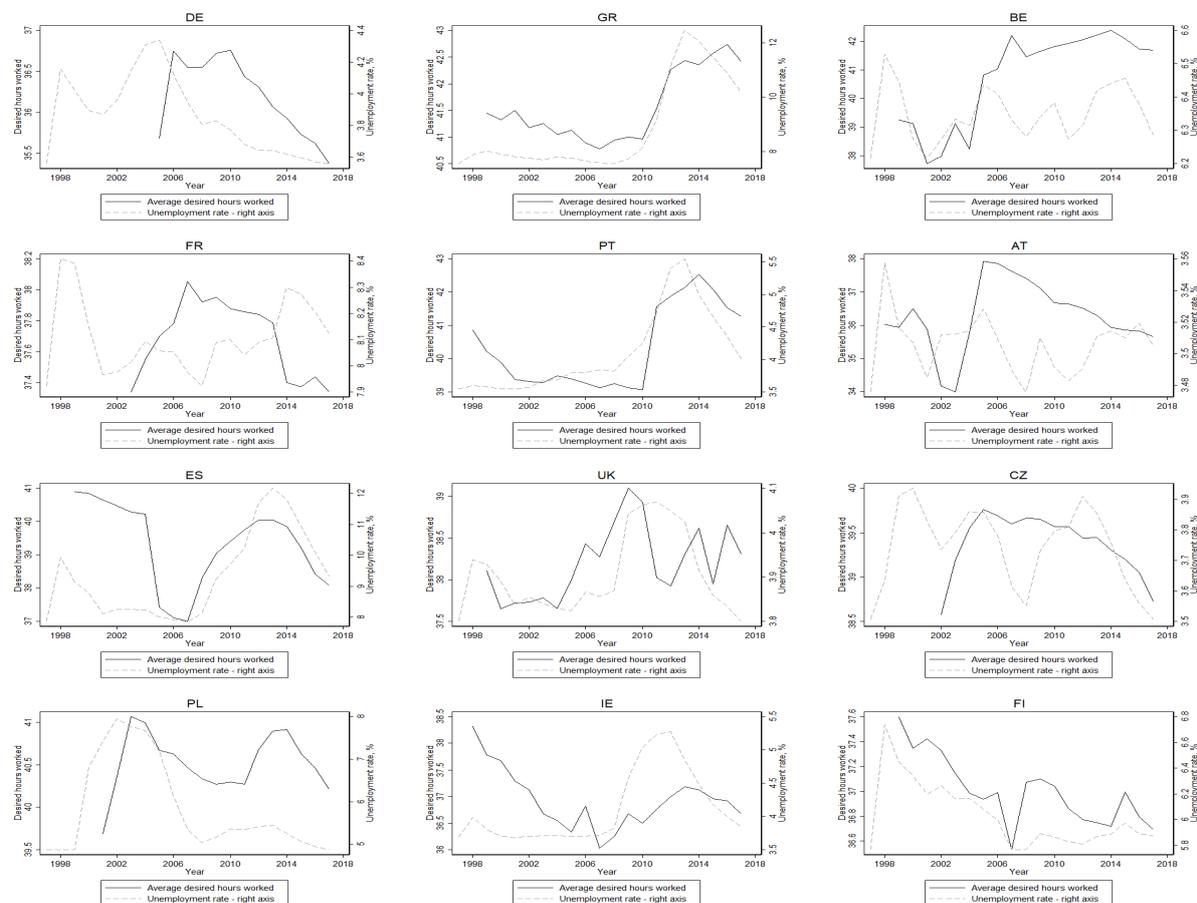
the opportunity cost of leisure decreases in recessions, individuals are likely to want to work more hours due to restricted outside options or lost income. The lost income could be driven by lower wages, lower actual hours worked available or more uncertain contracts prevalent on the labour market. Therefore the empirical finding offers a labour market puzzle to be further modelled in the theoretical literature. Finally, I find that the underemployment during recessions is driven by the labour supply changes, in addition to the demand adjustments. The Great Recession clearly was a labour demand shock. However, it also caused a positive labour supply shock, as identified in this paper.

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A Desired hours over the business cycle

Figure 5: Countercyclicity of desired hours: unemployment rate



Notes: This figure plots average desired hours worked for employed individuals in each country in each time period, with the unemployment rate as an alternative measure of recessions. As can be seen, the unemployment rate and average desired hours co-move over time.

Table 7: Pearson correlation coefficients with desired hours worked

	DE	FR	AT	UK	FI	PL	PT	GR	ES	IE	BE	CZ
GDP pc growth rate	0.0696	-0.210	0.0926	-0.666	0.135	0.123	0.0192	-0.201	0.0446	0.399	-0.341	-0.0342
Unemployment rate	0.296	-0.630	-0.215	0.367	0.829	0.144	0.782	0.925	0.277	-0.0291	0.430	0.398

Notes: This table shows the Pearson correlation between average desired hours and macroeconomic indicators of recessions over time. It supplements Figures 1 and 5 and stylized fact 1, which says that desired hours are countercyclical. I test this hypothesis formally in the empirical section.

B Desired hours breakdowns

Figure 6: Average desired hours by income decile and income decile composition

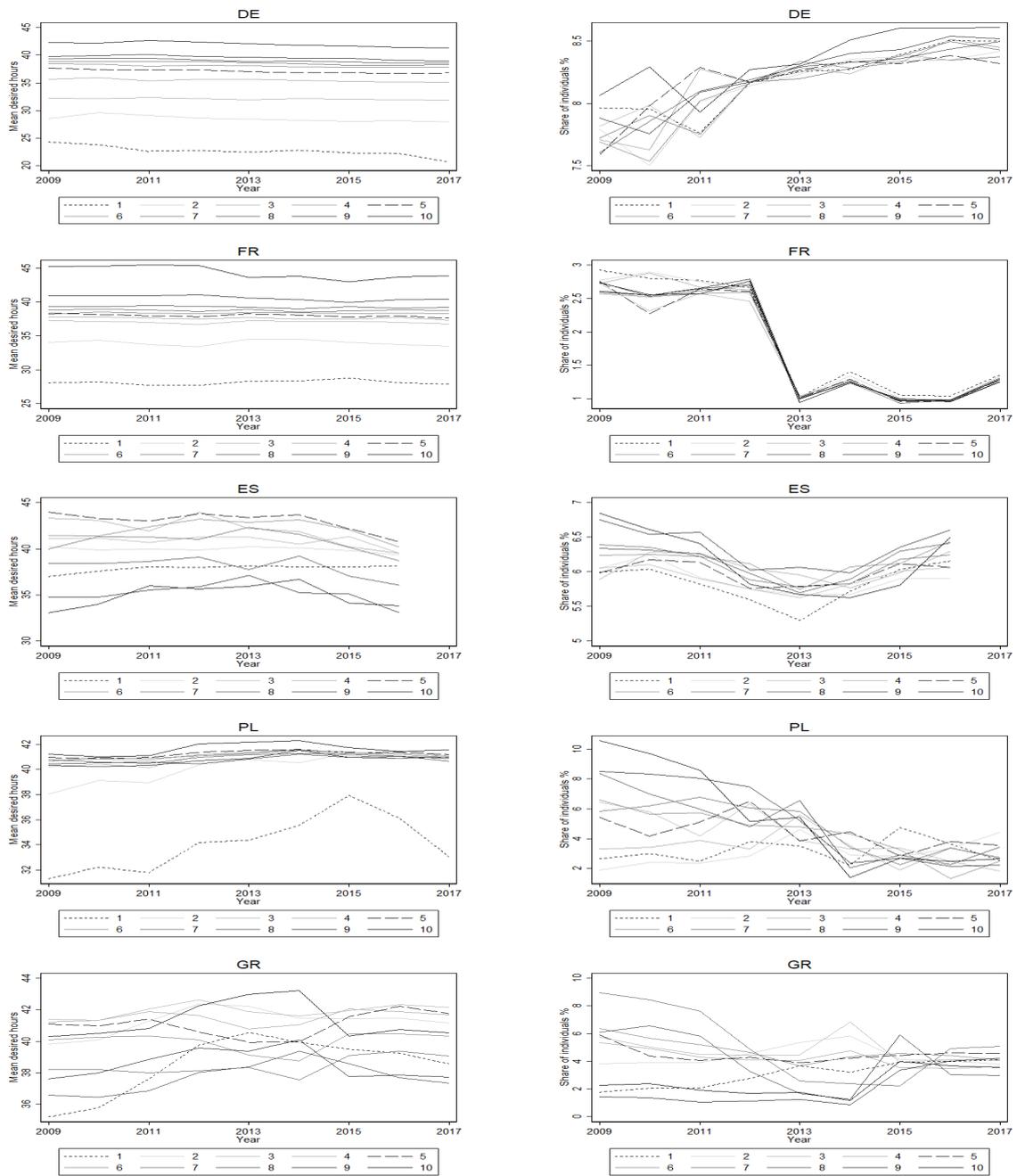


Figure 6: Average desired hours by income decile and income decile composition

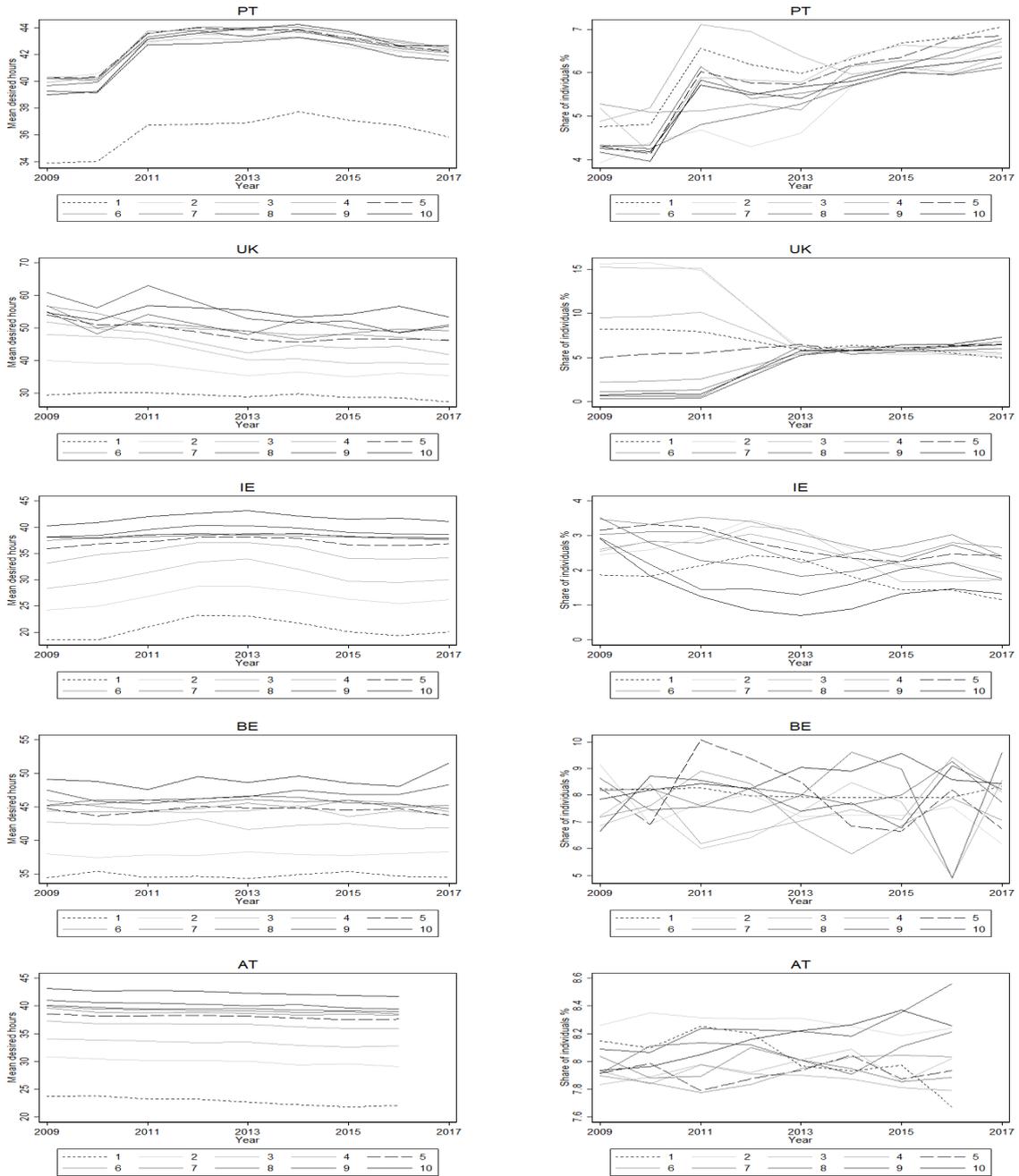
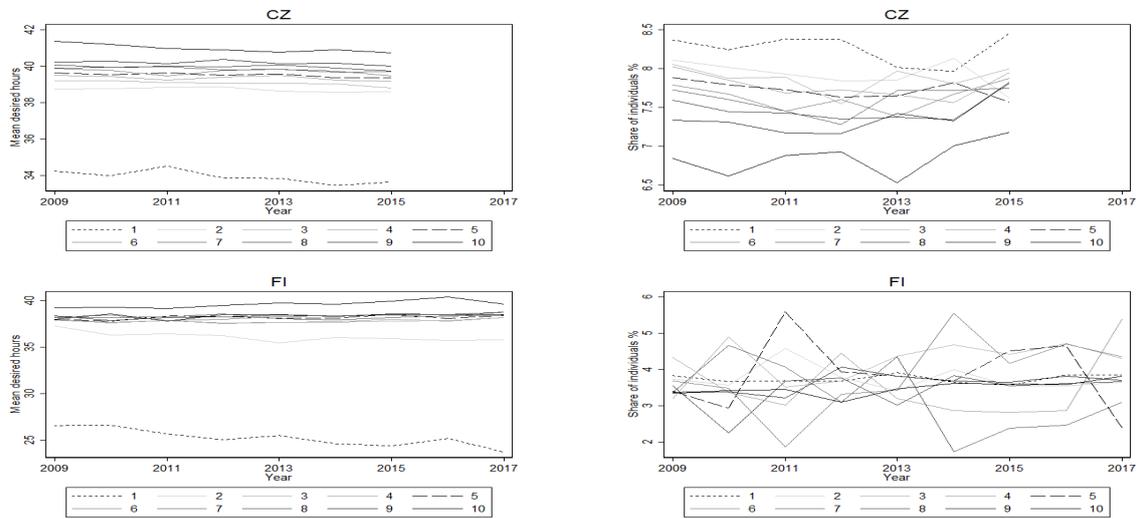
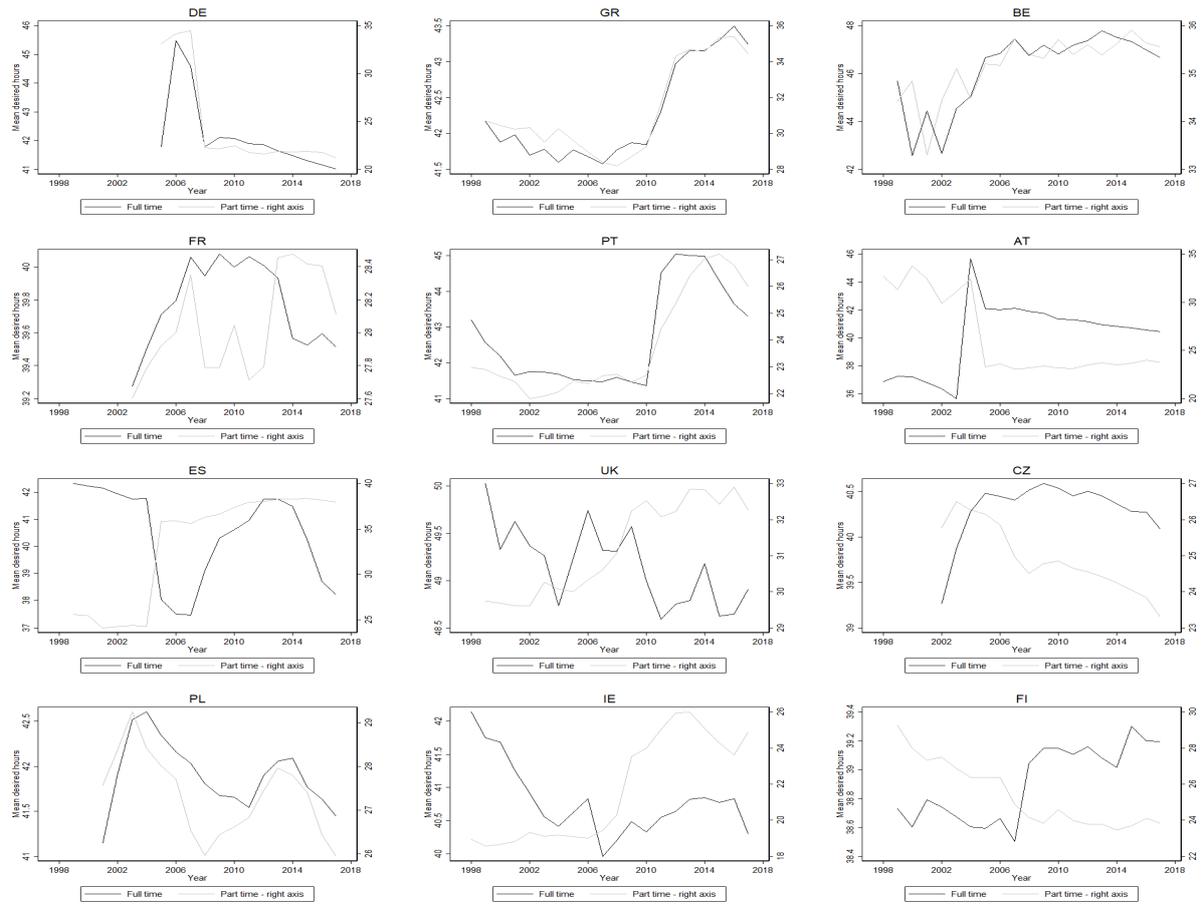


Figure 6: Average desired hours by income decile and income decile composition



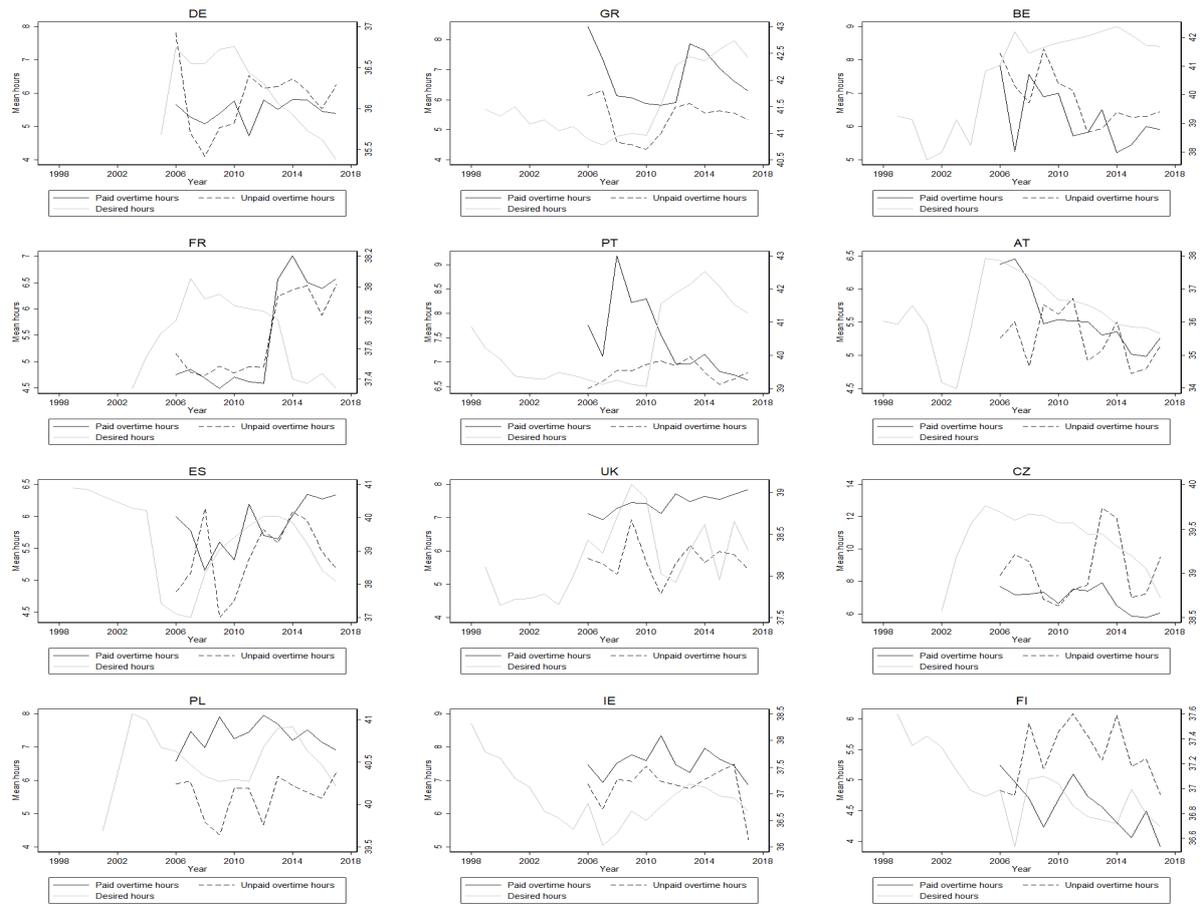
Notes: This figure plots average desired hours worked per each income decile, in each country over time in the left column. On the right are plotted shares of employed individuals in each income decile. Since the samples are not panel, it is possible that the changes in desired hours worked for each decile occur due to the composition effect. However, the right-hand-side column shows mostly stable shares of individuals in each income decile or patterns of income decile shares which do not correspond to the patterns of desired hours by income decile.

Figure 7: Average desired hours for part-time and full-time workers



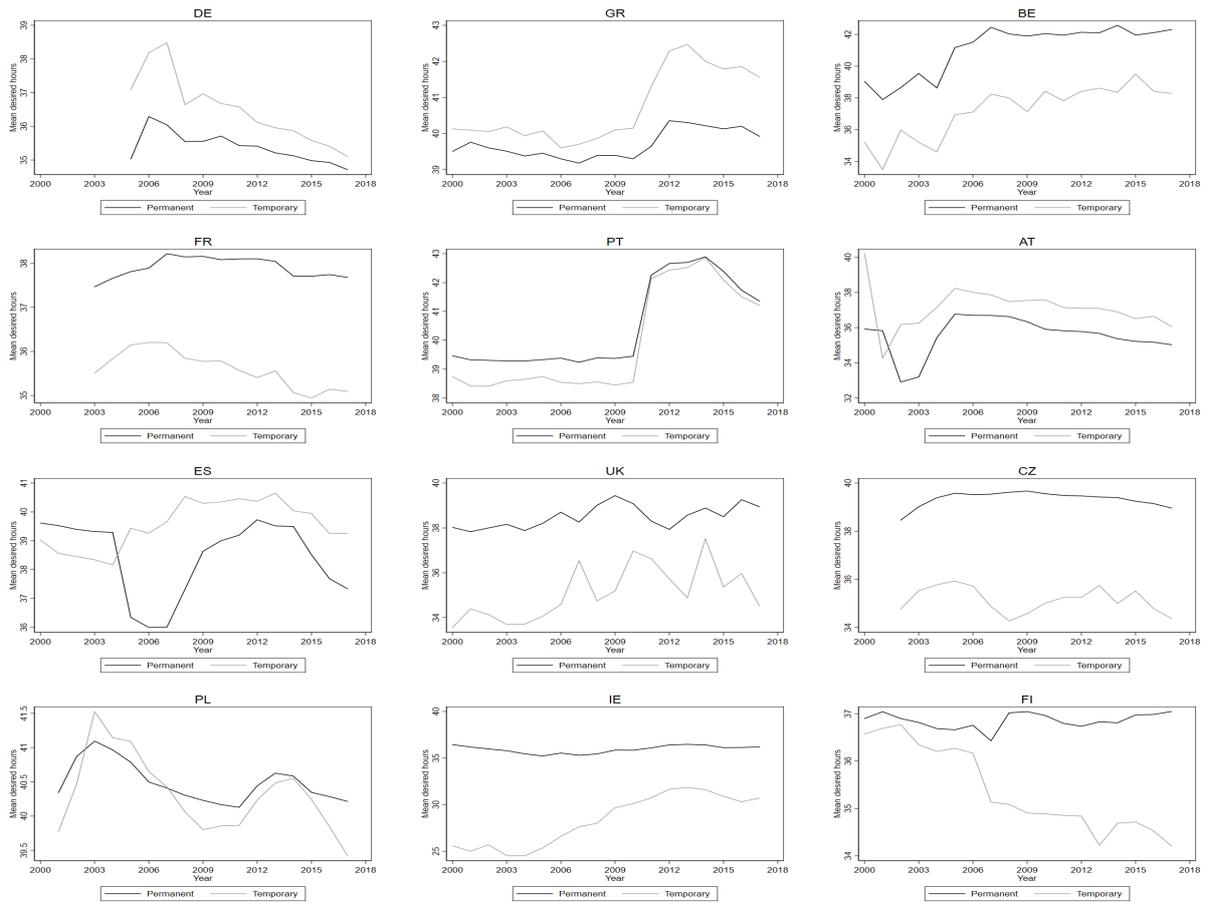
Notes: This figure plots average desired hours worked for full-time and part-time workers. In most countries, a change in desired hours of part-time workers is accompanied by the change in desired hours of full-time workers. These statistics descriptively signal that part-time workers may not be the main drivers of the desired hours countercyclicity.

Figure 8: Average overtime (from 2006) and desired hours worked



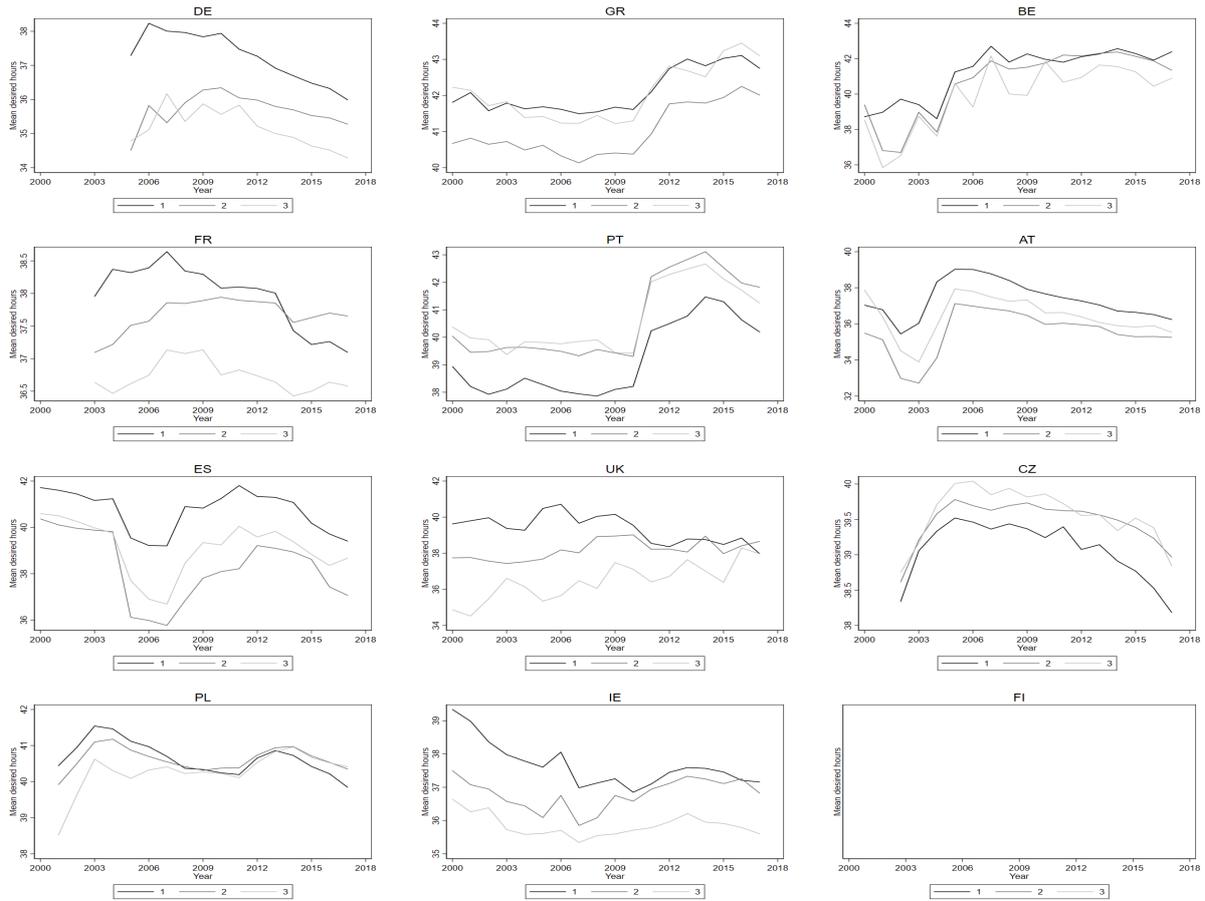
Notes: This figure plots average desired hours worked and average overtime hours over time. The correlation of desired and overtime hours seems to be idiosyncratic and depend on the type of overtime hours (paid or unpaid)

Figure 9: Average desired hours for temporary and permanent workers



Notes: This figure plots average desired hours worked by the type of contract. I assume that temporary workers would want to work more hours before their contract ends. In some countries, like Portugal, temporary contracts were very common during the Great Recession. Even though it seems that there is no apparent pattern for desired hours over time, the empirical analysis is more revealing and shows that temporary workers would increase desired hours in high unemployment areas, at least in some countries.

Figure 10: Average desired hours by the number of workers in the household



Notes: This figure plots average desired hours worked by the number of employed individuals living in one household. The hypothesis is that if a partner of the interviewee lost a job in a recession, she would want to work more hours to compensate for the lost income on the household level. There is no common pattern of the desired hours given this breakdown, however I use this variable as a control in the empirical specification.