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MACROECONOMIC DETERMINANTS OF INVOLUNTARY PART-TIME EMPLOYMENT IN GERMANY

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Macroeconomic Determinants of Involuntary Part-Time Employment in Germany*

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Abstract

In times of economic crisis, employers in the US and UK reduce their employees' working hours, which results in a higher incidence of involuntary part-time work (IVPT). German labor market regulations make hours adjustments more difficult as employers need employees' consent. Against the background of this institutional difference, we use a panel regression framework that exploits federal state level variation to investigate the influence of cyclical, structural and institutional factors on the incidence of IVPT in Germany. In most sectors, unemployment is a key driver of IVPT. Since unilateral downward hours adjustments are hampered by regulation, we investigate the relevance of different channels that potentially explain the positive influence of unemployment on IVPT. It mainly stems from shifts in bargaining positions over the business cycle and from added labor supply on the intensive margin, that is, extended supply of already employed workers.

Keywords: Involuntary part-time, Business cycle, Unemployment, Structural change, Labor market institutions

JEL Codes: E24, J21, J22, J23

1 Introduction

The neoclassical model of the labor market suggests that workers are free to choose their working hours at a given wage rate and are thus on their supply curves. However, empirical evidence shows that there is a substantial number of employees who work significantly shorter hours than they would like to. People who work part-time hours despite preferring a full-time job are considered involuntary part-time workers. Involuntary part-time work (IVPT) has gained a lot of attention in the aftermath of the Great Recession as IVPT rates have risen in many countries and often have remained elevated even when the economy recovered. In 2014, Janet Yellen emphasized IVPT as one of the main reasons *"why the current level of the unemployment rate may understate the amount of remaining slack in the labor market"*.[1] The situation in Germany is different insofar as the crisis of 2009 had no comparable impact on unemployment and also not on IVPT. While IVPT shares show different trends in the US and in Germany, their levels have been similar at rates between 3 and 6% in the last decade.

The incidence of IVPT is relevant from a macroeconomic perspective as it is a measure for labor underutilization that provides information on the state of the labor market in addition to prevailing measures like the unemployment rate. As such it has been found to be indicative of other labor market developments: It can, for example, partly explain why wage growth has been lagging behind expectations (see for instance Bell and Blanchflower 2018a; Hong et al. 2018). From a microeconomic perspective, IVPT is equally important as it implies that workers cannot tap their earnings potential. Not only do they earn less because of their reduced hours volume, but they also earn lower hourly wages than workers in similar full-time jobs (see for example Glauber 2017; Golden 2016). Working below one's desired hours has substantial negative effects on workers' happiness, as shown by Bell and Blanchflower (2018b) and Friedland and Price (2003). A high incidence of IVPT may thus have negative welfare effects.[2]

Recent work by Valetta, Bengali and van der List (2020) provides a comprehensive framework to evaluate the influence of cyclical as well as structural factors on the incidence of IVPT. While cyclical factors are those changes which occur over the business cycle, structural factors are long-term changes in the industry- and

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[1] Janet L. Yellen, Chair of the Board of Governors of the Federal Reserve System at the Federal Reserve Bank of Kansas City Economic Symposium.

[2] However, Borowczyk-Martins and Lalé (2018) find that IVPT generates smaller welfare losses than unemployment because of a much higher probability to return to full-time employment from part-time work than from unemployment.

occupation- as well as the workforce-composition. Specifically, these capture demographic changes as well as the shift towards a more service-oriented economy, which can be observed throughout Western countries. Taking these aspects into account, the authors are able to fully explain the development of IVPT in the US since 2006. They find that IVPT behaves strongly countercyclically. Further studies by Borowczyk-Martins and Lalé (2019), Lariau (2017), Mukoyama et al. (2019), and Warren (2016) document that its cyclicality is mainly driven by within firm transitions between full-time and part-time. Employers reduce their employees' working hours in economic downturns which results in a higher incidence of IVPT. However, while the initial rise during the crisis can thus be attributed to cyclical factors, the persistent elevation of the level of IVPT can be explained by structural shifts rather than by cyclical dynamics.

We analyze the determinants of IVPT in Germany by applying the approach of Valletta et al. to data from the European Labour Force Survey. While there is a literature concerned with individual working hours and the discrepancy to desired hours in Germany,[3] there is no analysis from a macroeconomic perspective to the best of our knowledge. Focusing on Germany is particularly interesting for the following two reasons. First, the German labor market is especially interesting because its experience of the Great Recession was quite different compared to other developed countries: while the economy suffered a large downturn in terms of GDP, this did not lead to a noticeable rise in unemployment. Therefore, we focus on unemployment as the cyclical indicator. Second, German labor market regulation is far more extensive than in the US.[4] In particular, it is more difficult for German employers to decrease their employees' hours unilaterally. This hampers downward hours adjustments by firms during recessions and raises the question whether there is cyclical movement in IVPT.

Exploiting variation in structural and cyclical factors within German federal states over time, we find that unemployment contributes positively to changes in the prevalence of IVPT. Thus, despite the much stricter regulations in Germany, the relationship between unemployment and IVPT is the same. However, it is attenuated as the quantified effect is half as large as in the US. Further analysis shows that this connection exists within most sectors and that our finding on the aggregate level is not driven by compositional effects.

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[3]See for example Ehing (2014), Fischer et al. (2015), Holst and Bringmann (2016), Knaus and Otterbach (2018), Rengers (2015), Schäfer (2018), Seifert et al. (2016a), Sopp and Wagner (2017), Tobsch et al. (2018), Wanger and Weber (2016), and Weber and Zimmert (2018).

[4]See for example the respective OECD indicators, `http://www.oecd.org/employment/emp/oecdindicatorsofemploymentprotection.htm`, accessed October 11th 2019.

We further investigate the mechanisms that underlie the positive association between unemployment and IVPT. Since transitions from full- to part-time at the same employer are relatively more costly for employers in Germany, we evaluate the relevance of different alternative channels. We find that the cyclicality mainly stems from two different kinds of mechanisms: The first is a shift in bargaining positions over the business cycle. The respective bargaining positions of employees and employers depend on the level of unemployment. When unemployment is high, employers can enforce a preferred part-time hours contract more often when hiring new workers and transitions from IVPT to full-time are less probable. The second relevant mechanism stems from additional labor supply of employed workers in times of high unemployment, especially from a change in desired hours of former voluntary part-timers who would then like to work full-time. We calculate yearly transition probabilities using additional data from the Mikrozensus which support those mechanisms.

There are certain particular forms of employment in Germany that could drive the development of IVPT: We consider the share of marginally employed, the share of employees using working time accounts and the share of short-time workers in the state-level analysis to evaluate the influence of these employment forms. Only the incidence of working time accounts is relevant for the development of IVPT, the correlation being positive. Adding these variables does not qualitatively change our main findings.

We consider different potential sources of heterogeneity. We find that the connection of unemployment and IVPT is larger in Western Germany and that it has been larger since the Great Recession. Meanwhile, our findings do not suggest any relevant changes that could be attributed to the Hartz reforms.

In Section 2, we give a short overview of our data and key measurement concepts. Section 3 provides the theoretical (3.1) and institutional (3.2) background for our analysis. It also contains descriptive evidence regarding the cyclicality of IVPT in Germany and structural factors associated with it (3.3). We turn to our regression analysis in Section 4. After presenting the empirical strategy (4.1) and the main results (4.2), we apply the same approach on the sectoral level (4.3) and disentangle the mechanisms underlying the association of unemployment and IVPT (4.4). In Section 5, we confirm that our key findings do not depend on specific forms of employment. In Section 6, we present our heterogeneity analysis with regard to Eastern and Western Germany, years before and after the Great Recession and the time period after the Hartz reforms. Section 7 concludes.

2   Data and Key Concepts

In this Section, we describe our data and present some key measurement concepts. We primarily use yearly cross-sectional micro data from the European Labour Force Survey (LFS), which collects demographic and employment information on households in European Countries. For Germany, it includes about 830,000 respondents each year. Our analysis covers the time period 2002 through 2017, as information on federal states ("Bundesländer") is only available as of 2002. Since we exploit variation of cyclical, structural and institutional factors on the federal state level, this information is crucial.

The LFS provides information on relevant socio-demographic characteristics of employees and on their occupation as well as industry. Most importantly, it allows for the identification of (involuntary) part-time workers. The definition of part-time work varies in the literature. The part-time measure in the LFS is based on self-assessment, but 95% of self-identified part-time workers work 31 hours or less, which is in line with rather restrictive part-time definitions in the literature. To make sure we only rely on plausible self-assessments, we further restrict our definition of part-time work to those working no more than 35 hours in total.[5] Respondents are also asked why they work part-time. Those which are in part-time employment because they "could not find a full-time job" are considered IVPT. If instead respondents state to work part-time for family or school related reasons for example, they are working part-time voluntarily.

Our main indicators of interest are the yearly unemployment rate and the share of IVPT workers in all workers.[6] Similarly, the influence of structural factors will also be measured as the share of a certain demographic group or industry in the whole population or all employed persons. To have an internationally harmonized measure of unemployment we use the ILO definition. Respective data on unemployment and GDP growth is drawn from Eurostat.

Some steps of our analysis require further information. Additional data is necessary to calculate transition probabilities in Section 4.4.2. Here we use the Mikrozensus, which can be combined into a panel in certain time periods. Since it forms the basis of the LFS, the measurement of IVPT is identical in both data sets. We are interested in aggregate-level transition rates between employment states which we

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[5]This means that respondents who work more than 35 hours by combining two jobs are not considered as involuntary part-timers.

[6]We use non-self-employed, non-agricultural employment for our analysis and further exclude workers producing for own use and employees of extraterritorial organizations and bodies.

relate to federal state level variation of labor market conditions. This information is available on a yearly frequency. To consider the incidence of particular German employment forms in Section 5, we need data on the prevalence of these types of employment on the federal state level. Analogous to our main analysis, we calculate the share of marginally employed jobbers, the share of workers on short-time work compensation and the share of workers using working time accounts relative to all workers to account for them in our empirical analysis. For this, we draw on data from the Federal Employment Agency as well as the Socio-Economic Panel. The Appendix A.2 provides an overview of our data sources.

3   Involuntary Part-Time: Theory and Evidence for Germany

As involuntary part-time is driven by the demand-side per definition, we provide some theory on the demand for part-time at the beginning of this section. We then briefly outline the institutional setting for the creation of part-time work in Germany before presenting descriptive evidence for Germany in the last subsection.

3.1   Demand for Part-Time

Involuntary part-time occurs when the demand for part-time labor exceeds its supply. Although fixed costs of employment have decreased over time, they are still relevant for most jobs (see for example Neubäumer and Tretter 2008).[7] There are indeed a number of reasons why employers might prefer part-time employees over full-time employees despite higher overall fixed costs. We outline the most important ones briefly in the following.

Employers hire part-time employees for production requirements. Some firms face regular and predictable demand peaks. Hiring part-time workers allows them to use their work force more flexibly. The need for part-time labor can also stem from opening hours that cannot be adequately covered by full-time staff. Studies on the determinants of part-time demand find that part-time work can increase firm productivity for those reasons (see for example Devicienti et al. 2015; Euwals and Hogerbrugge 2006). If those industries which require a high degree of flexibility become relatively more relevant compared to those which rely more on full-time

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[7]Fixed costs can stem from trainings, bureaucracy etc.

work, this will result in a higher share of involuntary part-time, all else being equal.

Other reasons for using part-time labor stem from business cycle developments, for example if employers prefer decreasing working hours over laying off part of their work force during economic downturns. This is mainly due to employers' incentives to hold on to human capital and to avoid redundancy payments.[8] This reasoning implies a negative relationship between economic activity and the incidence of IVPT. In fact, IVPT is observed to behave countercyclically in many countries (see for example Bell and Blanchflower 2018c; Borowczyk-Martins and Lalé 2019; Cajner et al. 2014; Valletta et al. 2020). Moreover, some employers hire part-time employees to screen them for full-time positions. If they are risk-averse, they will be even more likely to do so in periods of economic downturns to decrease uncertainty (Buddelmeyer et al. 2004).

Depending on the institutional framework, legal requirements might impose additional incentives for using part-time labor or prevent employers from doing so.[9] Therefore, country-specific regulations have to be taken into account as well.

3.2   Institutions and the Choice of Working Hours

Whenever the choice of part-time hours is demand driven, it can be assumed to result at least partly in IVPT. In Germany, however, employers' choices of working hours are restricted in many ways, suggesting that some of the aforementioned mechanisms do not apply on the same scale as in other countries. We will outline the legal framework briefly below, differentiating between new contracts and existing contracts.

When negotiating a new employment contract, employers and employees are fairly free in choosing the number of working hours. The framework within which the negotiations can take place is mainly restricted by laws that limit the maximum permissible working time.[10] Further restrictions may result from collective or works council agreements. Within that scope, negotiation outcomes can be assumed to depend on employers' and employees' preferences as well as their respective bargaining

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[8]For a formalization see for example Hart (2017).

[9]In the US, the Affordable Care Act (ACA) imposes institutional incentives for using part-time work (see for example Even and Macpherson 2015; Garrett 2014; Jolevski and Sherk 2014).

[10]According to the regulation in § 3 ArbZG ("Arbeitszeitgesetz"), the daily working time of employees may not exceed eight hours. It can only be extended up to ten hours if within six calendar months or within 24 weeks, an average of eight hours is not exceeded. Based on six working days per week the ArbZG allows a working week of 48 hours (exceptionally 60 hours).

position.[11]

If employers hire part-time employees, they are bound to treat them equally to full-time employees[12] by the European Council Directive 97/81/EC and respective German law, with exceptions for marginal employment ("minijobs"). Marginal employment is a particular German form of employment which is defined by income limits.[13] Especially with binding minimum wages, those limits imply a maximum number of working hours. Minijobs are partly exempt from social security contributions, which creates additional incentives for restricting working hours. In 2003, the Hartz reforms inter alia expanded the possibilities to hire marginal employees. In Section 5, we examine whether marginal employment plays an important role in the extent of IVPT. In many respects, the Hartz reforms can be considered the most important set of reforms of the German labor market as they brought about fundamental changes in the regulation of different forms of employment and in unemployment benefits. We therefore come back to those reforms at various points in the analysis, particularly in Section 6. While it is important to take the Hartz reforms into account, they are not the main focus of this analysis (for an overview of the reforms and their performance see for instance Jacobi and Kluve 2006).

Once an employment contract is in force, there may be various reasons to change the working hours that employers and employees initially agreed on. From employers' perspective, organizational requirements might change over time. Even more importantly, the economic situation might change. Borowczyk-Martins and Lalé (2019) show that employers in the US and UK adjust employment via the intensive margin. They observe that the share of part-time workers strongly increases during recessions. This rise is due to changes in the transitions between full-time and part-time rather than transitions between unemployment/non-employment and part-time. Moreover, these transitions between full- and part-time work mostly occur at the same employer. In Germany, however, reductions of working hours are usually only possible if employees agree to them unless flexible hours have been stipulated.[14] Unilateral reductions are only admissible in particular circumstances which we explain in the next paragraph. This major difference to the far more

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[11]The fact that the distribution of realized hours peaks at certain numbers of working hours can most likely be explained by related administrative advantages.

[12]Legally, part-time and full-time work is not clearly defined by a specific working time. Instead, the respective employment relationship is taken into account. The benchmark is a comparable full-time employee of the same company. If an employee regularly works less, he is legally considered as a part-time worker.

[13]The income may not regularly exceed 450 euros.

[14]Contracts that stipulate on-call working hours, especially those that do no stipulate a minimum number of working hours, are rare in Germany (see for example Tobsch et al. 2012).

liberal labor markets in the UK and especially in the US motivates our analysis.

In Germany, there are a number of exceptions that allow employers to unilaterally reduce working hours under very restrictive circumstances for a certain time span. The most important are the following two: First, short-time work ("Kurzarbeit") is a government subsidy which firms can apply for when they face short-term demand slumps (firm-specific component) and which is also frequently facilitated during recessions (discretionary component)(Balleer et al. 2016). In short-time work, working hours are reduced and associated losses in income are compensated at a rate of about 60% by the social security system or the state. Whether short-time work results in IVPT cannot be predicted easily as it depends on employees' preferences regarding hours/wage combinations. Second, working time accounts ("Arbeitszeitkonten") allow for adjusting working hours dynamically. The basic idea behind working time accounts is that over a certain period of time employers can have their employees work longer or shorter hours than collectively agreed. Employees thereby collect working time credits or debits in an individual working time account, which are later compensated for by additional free time or work. Theoretically, the use of working time accounts can have opposing effects on the incidence of IVPT.[15] In Section 5, we also look at the influence of short-time work and working time accounts on the incidence of IVPT.

Not only employers, but also employees might want to change their working hours. Employers are usually obligated by the "Teilzeit- und Befristungsgesetz" (TzBfG) to allow for a reduction of working hours unless they qualify for exceptions because of certain firm characteristics. Since the amendment of the "Bundeselterngeld- und Elternzeitgesetz" (BEEG) in 2015, it has been even easier for parents to reduce hours.[16] This should not lead to IVPT. However, while part-time employment might be voluntary at first, it can result in IVPT if preferences for working hours change again. Until last year, employees had only been allowed to reduce hours, but had not been entitled to increase them again against their employer's will. This is especially relevant for women, who often reduce their working hours after childbirth and want to increase their working time again when the child has reached a certain age.[17]

Summarizing, unlike in the US, employers' choices of working hours in Germany

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[15]In addition to these two important exceptions, there are working time corridors as a further instrument, which is, however, not widely used (see for example Burda and Hunt 2011).

[16]Further important institutions include partial retirement ("Altersteilzeit").

[17]However, since 2019, employees can opt for a temporary reduction of hours under certain circumstances ("Brückenteilzeit"). Whether the new law applies, depends mainly on the size of company and operational and organizational particularities. As our sample period does not include 2019, this does not affect our analysis.

are restricted in many ways. Reductions of working hours are thus relatively more costly for employers. This raises the question whether employers adjust differently to economic shocks.

3.3 Descriptive Evidence on IVPT in Germany

Here we present some key facts on the incidence of IVPT in Germany as well as its cyclicality and variation across demographic groups, occupations, industries and federal states.

Figure 1: IVPT and Unemployment in Germany
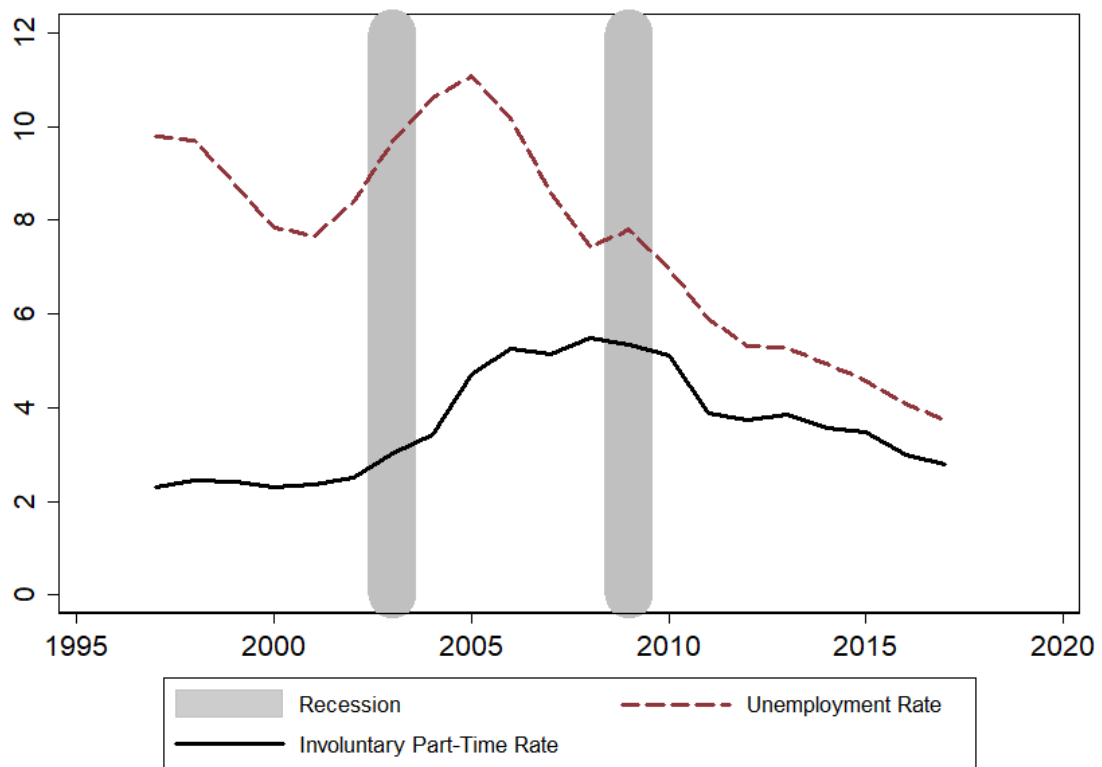
Source: European Labour Force Survey and Eurostat, own calculations.

Before turning to the federal state level, Figure 1 illustrates the aggregate time-series patterns of IVPT as a share of total employment and the unemployment rate between 1997 and 2017, and puts them in the context of recession periods. IVPT ranges between 2.2% and 5.5%, which is a magnitude quite comparable to other developed countries (see for example Glauber 2017). However, contrary to other economies like the US or the UK, there are no clear cyclical patterns from an aggregate perspective. IVPT and unemployment develop in a somewhat parallel

manner, but there seems to be no particular response to recessions.

As mentioned earlier, the unemployment rate and GDP growth are not as closely related in the German economy as they are in other countries. While the fall in GDP growth experienced in the crisis of 2009 was the largest since the second world war (Rahlf 2015), there was no equivalent rise in unemployment. The causes of this particularly German phenomenon have been studied extensively by other authors (see for example Burda and Hunt 2011; Rinne and Zimmermann 2012).

Figure 2: IVPT and Unemployment/GDP Growth in German Federal States
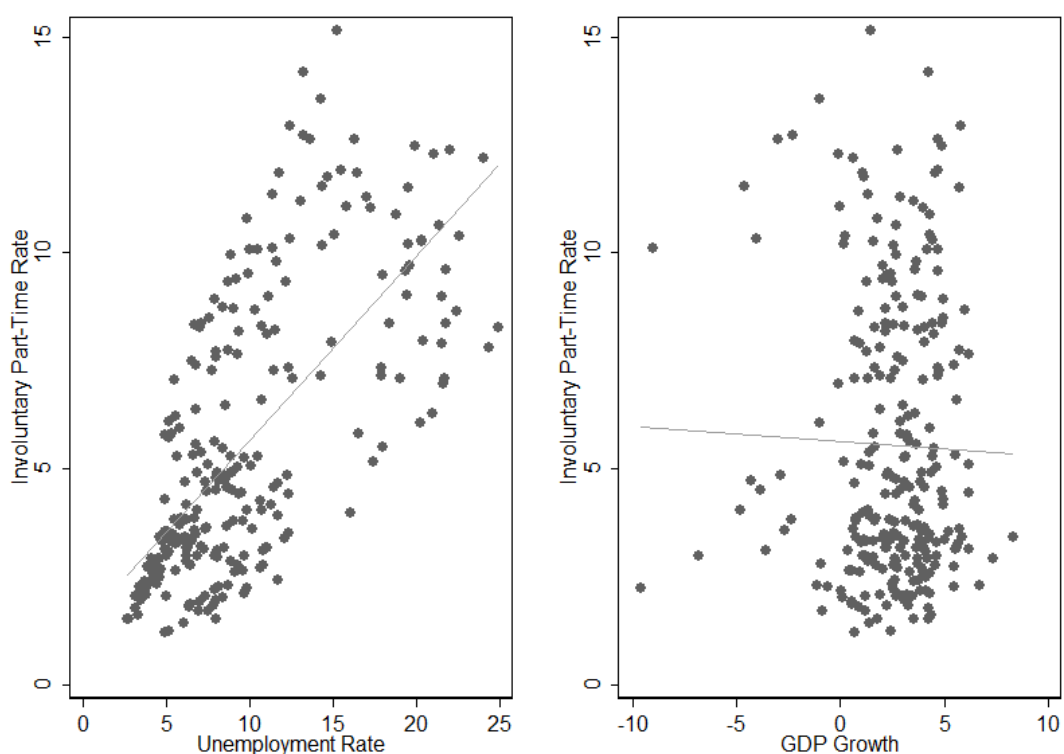
Source: European Labour Force Survey and Eurostat, own calculations.

To learn more about the determinants of IVPT we exploit state-level variation in the considered variables. In terms of cyclicality, we consider federal state specific GDP growth and unemployment. The relationship of these indicators with IVPT is plotted in Figure 2. Each dot represents a pair of either the unemployment rate (left panel) or the GDP growth rate (right panel) and the IVPT rate at a given year between 2002 and 2017 in a federal state. As suspected from Figure 1, there is a positive correlation between unemployment and IVPT, despite substantial deviation from the fitted line. As there seems to be no relationship of IVPT with GDP growth on the federal state level, we focus on unemployment as the key cyclical indicator

in our empirical analysis. We do, however, control for the influence of GDP growth.

We now turn to structural factors that are potentially related to IVPT. To this end, Table 1 provides further information on the incidence of (involuntary) part-time by demographic groups, federal states, occupations and industries. It reads as follows: for any given row, the table lists the share of the respective group that works part-time (involuntarily) for the years 2002, 2010 and 2017 in order to span our sample period. Additionally, the last three columns of Table 1 provide information on the overall employment share of each group.

As can be seen in the first part of Table 1, there is considerable variation in the incidence of IVPT across demographic groups. Both part-time in general and IVPT are more prevalent among women, a finding which is in line with the literature on working hours in Germany (see for example Schäfer 2018). Depending on gender, the share of IVPT also differs strongly between age groups. Moreover, patterns over time are qualitatively rather similar but differ in the magnitude of variation. Employment shares of the demographic groups[18] mostly rather stable except for those of older groups, which also have a comparatively high share of IVPT. As such, shifts in the demographic composition of the workforce as well as developments over time within groups can influence the level of IVPT, which is why we account for demographics in our regression analysis.

The second part of Table 1 shows that the incidence of IVPT highly depends on occupations. IVPT is particularly prevalent in *Services and Sales* and *Elementary Occupations*, occupations which also have the highest rates of part-time use in general. Patterns in IVPT over time within occupational groups are rather similar. The opposite applies to occupation specific employment shares. While the employment shares of *Professionals*, *Services and Sales* and *Technicians* have been increasing, the employment shares of *Managers*, *Craft* and *Plant & Machine Operators* have been decreasing.[19]

The third part of Table 1 complements these considerations by looking at industries. Again, the incidence of IVPT differs greatly between them. As expected, it is particularly prevalent in categories that comprise services, like for example *Hotels and Restaurants*. The high relevance of part-time labor for service industries is

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[18]Note that Table 1 reports employment shares but that we use population shares of demographic groups in our regression analysis. Employment shares seem to be more informative in this aggregated view, while population shares cover the exogenous differences in labor supply between federal states more accurately.

[19]The structural shift towards service occupations has been most prominently discussed in the literature on employment and wage polarization (see in particular Autor and Dorn 2013) but also with respect to IVPT (Golden 2016).

frequently highlighted in the literature (see for example Buddelmeyer et al. 2004; Euwals and Hogerbrugge 2006). Organizational flexibility is often particularly important for service providers, whose businesses rely on certain opening hours and are subject to short-term demand peaks (see Section 3.1).

Both, variations in industry shares and occupation shares between federal states and over time can be relevant for the prevalence of IVPT in a state. Even though they do not capture the exact same developments, they reflect related structural shifts. There is substantial overlap between sectors and occupations as mentioned above. Since we have a small sample and want to avoid overfitting, we choose to only include industry shares. Focusing on industries also proves insightful when conducting within industry analysis in Section 4.3.

Lastly, the bottom part of Table 1 shows the statistics by federal states. There are substantial level differences in the shares of part-time employment and especially in the shares of IVPT employment between states, with IVPT being particularly high in Eastern Germany. While the factors that we consider might account for part of those differences, further unobserved factors at the state level are important. Our regression analysis therefore only exploits within state variation.

Table 1: Incidence of (Involuntary) Part-Time Work by Labor Market Groups

	Involuntary Part-time			Part-time			Employment Share		
	2002	**2010**	**2017**	**2002**	**2010**	**2017**	**2002**	**2010**	**2017**
All	0.025	0.051	0.028	0.207	0.263	0.279	1	1	1
Demographic Groups									
All 17-26	0.020	0.041	0.019	0.140	0.221	0.258	0.116	0.109	0.096
Men 27-36	0.013	0.040	0.018	0.066	0.111	0.108	0.123	0.106	0.112
Women 27-36	0.033	0.057	0.032	0.318	0.349	0.337	0.100	0.091	0.094
Men 37-56	0.008	0.021	0.015	0.032	0.059	0.064	0.295	0.283	0.252
Women 37-56	0.051	0.088	0.045	0.449	0.519	0.521	0.243	0.248	0.226
All 57-66	0.026	0.061	0.037	0.233	0.267	0.297	0.113	0.147	0.193
All 67+	0.012	0.011	0.007	0.599	0.668	0.711	0.010	0.016	0.027
Occupations									
Clerks	0.021	0.052	0.019	0.292	0.344	0.336	0.130	0.122	0.132
Craft	0.008	0.021	0.012	0.046	0.069	0.082	0.168	0.147	0.125
Elementary Occupations	0.078	0.168	0.099	0.442	0.525	0.562	0.075	0.076	0.074
Managers	0.004	0.008	0.003	0.049	0.085	0.074	0.066	0.064	0.048
Plant Operators[20]	0.013	0.027	0.017	0.077	0.113	0.134	0.073	0.070	0.061
Professionals	0.019	0.020	0.013	0.162	0.199	0.241	0.139	0.163	0.185
Services and Sales	0.057	0.112	0.065	0.393	0.485	0.454	0.120	0.126	0.142
Technicians	0.020	0.037	0.016	0.209	0.262	0.268	0.214	0.219	0.231

Table 1 continued on next page.

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[20]and Machine Operators

	Involuntary Part-time			Part-time			Employment Share		
	2002	2010	2017	2002	2010	2017	2002	2010	2017
Industries									
Real Estate, Renting[21]	0.034	0.074	0.034	0.259	0.322	0.330	0.089	0.107	0.112
Construction	0.012	0.022	0.013	0.078	0.104	0.118	0.078	0.069	0.070
Education	0.053	0.074	0.038	0.349	0.410	0.438	0.058	0.067	0.069
Electricity, Gas and Water	0.003	0.028	0.008	0.063	0.104	0.110	0.008	0.013	0.014
Financial Intermediation	0.007	0.016	0.009	0.170	0.197	0.241	0.038	0.035	0.032
Health and Social Work	0.034	0.064	0.041	0.316	0.395	0.429	0.109	0.125	0.132
Hotels and Restaurants	0.057	0.099	0.069	0.295	0.443	0.456	0.035	0.040	0.038
Manufacturing	0.008	0.017	0.008	0.103	0.118	0.120	0.242	0.210	0.195
Other Services	0.038	0.075	0.043	0.296	0.401	0.428	0.058	0.042	0.043
Public Administration[22]	0.014	0.023	0.012	0.158	0.181	0.209	0.082	0.076	0.070
Transportation, Storage[23]	0.021	0.045	0.024	0.141	0.206	0.206	0.058	0.084	0.083
Wholesale and Retail Trade	0.040	0.085	0.042	0.296	0.351	0.332	0.143	0.131	0.142
Federal States[24]									
West									
SH	0.021	0.044	0.025	0.232	0.270	0.301	0.034	0.035	0.034
HH	0.025	0.034	0.024	0.222	0.247	0.250	0.022	0.023	0.024
NI	0.021	0.049	0.027	0.229	0.279	0.284	0.092	0.091	0.094
HB	0.031	0.069	0.039	0.235	0.353	0.319	0.007	0.007	0.008
NW	0.014	0.042	0.025	0.217	0.275	0.285	0.208	0.208	0.207
HE	0.018	0.040	0.023	0.216	0.275	0.293	0.078	0.076	0.077
RP	0.017	0.048	0.021	0.220	0.300	0.303	0.049	0.049	0.049
BW	0.011	0.032	0.019	0.224	0.270	0.290	0.139	0.138	0.142
BY	0.012	0.030	0.014	0.213	0.265	0.269	0.163	0.163	0.167
SL	0.019	0.029	0.019	0.224	0.282	0.293	0.012	0.012	0.011
East									
BE	0.049	0.073	0.051	0.205	0.263	0.273	0.041	0.041	0.044
BB	0.066	0.076	0.053	0.143	0.186	0.235	0.030	0.032	0.029
MV	0.074	0.095	0.055	0.146	0.215	0.299	0.019	0.019	0.018
SN	0.084	0.130	0.056	0.157	0.223	0.259	0.050	0.049	0.047
ST	0.060	0.124	0.069	0.122	0.205	0.225	0.028	0.028	0.024
TH	0.054	0.085	0.054	0.125	0.207	0.247	0.029	0.028	0.025

Source: European Labour Force Survey, own calculations.

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[21]and Business Activities

[22]and Defence

[23]and Communication

[24]Federal States: Schleswig-Holstein (SH), Hamburg (HH), Lower Saxony (NI), Bremen (HB), North Rhine-Westphalia (NW), Hesse (HE), Rhineland-Palatinate (RP), Baden-Württemberg (BW), Bavaria (BY), Saarland (SL), Berlin (BE), Brandenburg (BB), Mecklenburg-Vorpommern (MV), Saxony (SN), Saxony-Anhalt (ST), Thuringia (TH)

4 Empirical Analysis

4.1 Empirical Strategy

Similar to Valletta et al., we use a state panel regression framework that exploits variation in cyclical and structural factors within states over time. This approach allows to jointly account for changes in demand and supply factors. As argued by Valletta et al., considering those factors together is crucial to properly evaluate their respective roles as different structural changes may be offsetting one another.

We apply state fixed effects to control for unobserved differences between states. We also include year fixed effects which capture unobserved common developments over time. Thereby, we make sure that our results are not driven by nationwide regulatory changes, such as the Hartz reforms. As our dependent variable is a share, we also use the fractional regression method proposed by Papke and Wooldridge (1996, 2008). Observations are weighted by employment of the respective state. Standard errors are clustered by state, which allows correlation of errors within states but not between states. All tables report marginal effects at the mean, that is, the impact of a one percentage point change in the respective independent variable on the dependent variable, with all other explanatory variables held at their mean values.

Our main regression model is specified as follows

$$IVPT_{st} \quad = \quad \alpha + \beta u_{st} + \gamma u_{st}^2 + \zeta X_{st} + \varphi_s + \varpi_t + \epsilon_{st} \tag{1}$$

with s indexing states and t indexing years and $IVPT_{st}$ being the IVPT fraction of the employed population. Variable u_{st} represents the unemployment rate and u_{st}^2 is the square of the unemployment rate to control for non-linear effects. X_{st} represents a vector of structural variables that includes time and state dependent industry and demographic group shares.[25] It furthermore includes GDP growth as an additional cyclical control variable. State fixed effects are φ_s and year fixed effects are ϖ_t.

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[25]Note that we use population shares of demographic groups as opposed to employment shares as they cover the exogenous differences in labor supply between federal states more accurately. We obtain, however, qualitatively similar results when including employment shares instead.

4.2 Main Results

Table 2 shows the results. In the baseline specification (column 1), we only include u_{st} and u_{st}^2 as well as state and time effects. The marginal effect of regional unemployment on IVPT is positive and precisely estimated. In this specification, a one percentage point increase in the regional unemployment rate leads to a change of 0.273 percentage points in the IVPT share. The maximum difference between the lowest and highest regional unemployment rate in our sample period is 19 percentage points in Mecklenburg-Vorpommern. A change of this magnitude indicates a change in the share of IVPT of approximately 5 percentage points, an effect which is of economic significance. The effect of squared unemployment is negative which indicates that the relationship between IVPT and unemployment is not linear. Instead, the influence of unemployment becomes smaller as unemployment increases.

In column (2), we present a specification, which also includes the structural variables, only a few of which have a significant impact on the regional IVPT rate.[26] Higher shares of employment in *Wholesale and Retail Trade* and in *Electricity, Gas and Water Supply* are associated with a higher share of IVPT. Most of the structural factors are not individually significant, but the overall model fit does improve with their inclusion as indicated by a lower Akaike information criterion and the within R^2.[27] This is probably due to the fact that the demographic group and industry shares have been rather stable within states over the sample period compared to the cyclical indicators. Further, the respective group shares are correlated with each other and the sample size is rather small. However, a Wald test of joint significance indicates that the structural factors as a whole do affect the incidence of IVPT, but the effect cannot be attributed to single regressors. More importantly, the marginal effect of unemployment is almost unaffected by the inclusion of structural variables and most important in terms of effect size.

In column (3), we further add regional GDP growth to account for the cyclical dynamics in terms of output. The coefficient of the unemployment is almost unaffected. The other effects also remain qualitatively unchanged, besides a higher population share of men aged between 27 and 36 now significantly corresponding to a lower share of IVPT. The effect of GDP growth itself is positive. A one percentage point

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[26]This finding is in line with the results of Dietz et al. (2013) who conduct shift-share analyses that show that changes in atypical employment, which includes part-time employment, can hardly be explained by structural change.

[27]The AIC is a measure of goodness-of-fit for generalized linear models, comparable to the adjusted R^2 in linear models. The within R^2 is directly calculated from the sum of squares as demonstrated by Valletta et al.

Table 2: Involuntary Part-time, Regression Results

Share IVPT	(1)		(2)		(3)	
Unemployment Rate	0.273***	(0.0659)	0.251***	(0.0668)	0.253***	(0.0695)
Unemployment Rate Squared	-0.592***	(0.201)	-0.549***	(0.160)	-0.550***	(0.167)
GDP Growth					0.0432**	(0.0200)
Women 17-26			0.0267	(0.122)	0.0228	(0.120)
Women 27-36			0.00334	(0.134)	0.0337	(0.139)
Women 37-56			-0.0391	(0.131)	-0.0329	(0.130)
Women 57-66			0.0250	(0.148)	0.0365	(0.151)
Women 67+			0.0787	(0.514)	0.123	(0.524)
Men 27-36			-0.180	(0.118)	-0.202*	(0.114)
Men 37-56			0.00757	(0.122)	0.0173	(0.122)
Men 57-66			-0.0561	(0.149)	-0.0444	(0.151)
Men 67+			-0.283	(0.415)	-0.214	(0.436)
Manufacturing			-0.0136	(0.0547)	-0.0101	(0.0541)
Electricity, Gas and Water Supply			0.152*	(0.0840)	0.156*	(0.0875)
Construction			0.0405	(0.0474)	0.0458	(0.0509)
Wholesale and Retail Trade			0.136**	(0.0562)	0.142**	(0.0567)
Hotels and Restaurants			-0.0132	(0.105)	-0.0187	(0.102)
Financial Intermediation			-0.0924	(0.0828)	-0.100	(0.0810)
Real Estate, Renting and Business Activities			0.0805	(0.0579)	0.0797	(0.0552)
Public Administration and Defence			-0.0188	(0.0511)	-0.0160	(0.0468)
Education			0.00455	(0.0787)	0.00397	(0.0759)
Health and Social Work			0.00573	(0.0602)	0.0174	(0.0581)
Other Services			0.0571	(0.0613)	0.0557	(0.0592)
State Fixed Effects	Yes		Yes		Yes	
Year Fixed Effects	Yes		Yes		Yes	
AIC	0.2577781		0.2576841		0.2576776	
R^2 within	0.82		0.94		0.94	
N= 256						

Men 17-26 is omitted demographic group.

Transportation, Storage and Communication is omitted industry category.

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Source: European Labour Force Survey and Eurostat.

increase in output is associated with an increase of IVPT of 0.0432 percentage points. Bearing in mind that a change of that magnitude in GDP growth would be quite substantial, the effect it has on IVPT seems rather negligible. Moreover, as we show in the next section, it is only prevalent in a few sectors. Unemployment appears to be the far more important driver of IVPT.[28] Basically, it seems that the rather strict regulation of the German labor market does not prevent that high unemployment reduces the chances of employees realizing their desired full-time positions.

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[28]In Appendix A.1, we explore different specifications of the indicators presented here and of alternative indicators to confirm that unemployment is the main cyclical driver of IVPT in Germany.

4.3   Sectoral Analysis

From the literature it is well known that sectors are differently affected by cyclical developments (see for example Burda and Hunt 2011). So far, we account for between industry employment shifts and thereby do not cover sectoral differences in cyclical dynamics. In the following, we conduct the same analysis as before within industries. That is, we regress the regional IVPT share within a specific sector on regional characteristics, including the regional unemployment rate and regional GDP growth. Table 3 shows the results. Demographic shares and state as well as year fixed effects are included in all specifications but not shown.

In the majority of sectors, we find an effect of unemployment which is even larger than on the aggregate level. The positive GDP growth effect is only significant in three sectors: (1) *Manufacturing*, (3) *Construction* and (6) *Transportation, Storage and Communication.* These are industries in which GDP growth has been rather volatile. Especially for (3) and (6), the effect is larger than the aggregate GDP growth effect (Table 2). Within those two industries, we do not find a significant unemployment effect. In (10) *Education*, the effect of GDP growth is negative. This is consistent with cyclical volatility being rather low in this sector.

There are different potential explanations for a positive effect of GDP growth on IVPT in particular sectors. One hypothesis is that part-time labor is preferably hired during booms. This gives employers more flexibility in adjusting working hours as they cannot reduce employees' hours but can have them work overtime when necessary. Moreover, employees who only find IVPT jobs as the GDP growth is high, might be the first to lose their jobs when the economy turns down. This has been investigated as the "last hired, first fired" phenomenon in a large body of literature.[29] Other reasons for high IVPT in economic upturns could lie in expansions of labor supply. If individuals who were previously satisfied with part-time jobs suddenly offer full-time hours, this will likely result in additional IVPT. Such adjustments in desired working hours seem particularly likely when an upswing is accompanied by wage increases.

In summary, the positive effects of unemployment and GDP growth apply to distinct sectors. In most sectors, variation in IVPT can rather be attributed to changes in unemployment. The effect of GDP only plays a role in a few sectors and remains rather negligible in scope. In the remaining analysis, we therefore focus on unemployment as the cyclical indicator of interest.

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[29]For Germany, e.g Kogan (2004) investigates labor market spells of immigrants against this background.

Table 3: Involuntary Part-time within Industries, Regression Results

Share IPVT by NACE (Rev. 1.1)	Manufacturing	Electricity, Gas	Construction	Wholesale, Retail	Hotels, Restaurants	Transportation	Financial Interm.	Business Activities	Public Admin.	Education	Health, Social Work	Other
Unemployment Rate	0.164**	-0.299**	0.128	0.429**	0.769	0.0534	0.474***	0.277	0.553***	0.602**	0.0382	0.728*
	(0.0771)	(0.136)	(0.143)	(0.196)	(0.571)	(0.220)	(0.104)	(0.199)	(0.0957)	(0.241)	(0.204)	(0.388)
Unemployment Rate Sq.	-0.613***	0.917**	-0.0336	-0.687	-3.702***	-0.701	-1.108***	-0.428	-1.179***	-0.939	-0.0838	-1.680**
	(0.231)	(0.389)	(0.405)	(0.507)	(1.196)	(0.626)	(0.246)	(0.498)	(0.262)	(0.595)	(0.585)	(0.690)
GDP Growth	0.0589***	0.0569	0.153***	0.0658	0.0813	0.157*	0.00975	0.109	0.0438	-0.148*	0.00445	-0.117
	(0.0225)	(0.0551)	(0.0375)	(0.0607)	(0.109)	(0.0818)	(0.0516)	(0.0731)	(0.0566)	(0.0846)	(0.0873)	(0.155)
Demographic Group Sh.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N = 256												

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Source: European Labour Force Survey and Eurostat.

4.4 Unemployment and IVPT: Underlying Mechanisms

As shown in the last Section, unemployment is an important driver of IVPT. In the US, hours adjustments from full-time to part-time hours play a major role for the countercyclicality of IVPT (see for example Borowczyk-Martins and Lalé 2019; Lariau 2017; Warren 2016). Downward hours adjustments become attractive as the economy weakens. At the same time, they become more feasible because the labor market offers relatively little alternatives for employees. As outlined in Section 3.2, German regulation makes reductions in working hours more difficult as they usually require employees' consent. Consequently, involuntary hours reductions at the same employer are less relevant than they are in the US. Table 4 shows the share of transitions from full-time to IVPT in all IVPT inflows and the probability of staying with the same employer when transitioning from full-time to IVPT for Germany and for the US (the latter is taken from Borowczyk-Martins and Lalé 2016). The share of transitions from full-time to IVPT that take place at the same employer in all IVPT inflows is about three times higher in the US, and can account for less than 10% of all transitions in Germany.[30] This raises the question through which channels unemployment mainly influences IVPT instead. In this Section, we present different explanatory channels and investigate their relevance by first conducting additional regression analysis with different dependent variables (4.4.1) and second by looking at yearly transition rates between employment states (4.4.2).

Compositional effect: A higher unemployment rate could be associated with a higher share of IVPT due to structural reallocation. In Germany, the Great Recession primarily affected employment in manufacturing (see for example Burda and Hunt 2011). As manufacturing firms use relatively little part-time labor (see Table 1), this could have been responsible for an increase in IVPT's share in employment. Not only does a decrease in the employment share of full-time intensive industries lead to a decline in employment without a proportional decrease in IVPT, but it potentially also leads to relative employment growth in sectors that are comparatively IVPT intensive. However, by controlling for the industry composition in our regression analysis, we rule out that the influence of unemployment on IVPT is driven by this kind of interaction between cyclical and structural developments.

Added labor supply effect: Another potentially relevant mechanism consists in extended labor supply in times of high unemployment. It has been discussed with regard to the labor supply of married women. In the respective literature, labor

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[30]When multiplying the rates reported in Table 4 respectively, we obtain a share of about 9% for Germany and a share of about 29% for the US.

Table 4: Hours Reductions at the Same Employer in Germany and in the US

	Share of Transitions from FT to IVPT in all IVPT Inflows	Conditional Probability of Staying with the same Employer
Germany	$\approx$ 14 %	$\approx$ 66 %
US	$\approx$ 31 %	$\approx$ 95 %

Source for German data: RDC of the Federal Statistical Office and Statistical Offices of the Länder
Mikrozensus 2012-2015, own calculations.
Information on the US is taken from Borowczyk-Martins and Lalé (2016) and is based on monthly CPS data. Note that
it covers the longer period 2009(07)–2015(11).

supply of individuals is put in the context of family decision-making. If a household member becomes unemployed, this leads other, formerly inactive household members to enter the labor market in order to compensate for the transitory income loss.[31] This "added worker effect" refers to the extensive margin of employment. It could explain the influence of unemployment on IVPT if the additional workforce was particularly prone to becoming IVPT, which is not unlikely, given that they were only marginally attached to the labor force. By the same reasoning, there could be an "added hours effect" on the intensive margin of those household members who are already employed but have been working part-time and want to increase their hours when their spouse loses his or her job.

Bargaining position effect: High unemployment is associated with a weaker bargaining position of employees. Employers might consequently be able to enforce part-time hours that they have already favored before or favor as economic conditions worsen. Precisely, this could mean that employees who wish to increase their working time have less chance of negotiating an increase in hours with the existing employer and of finding a different job that resolves the hours mismatch when unemployment is high.[32] Along the same lines, unemployed people might be more willing to accept a job offer with less than their desired hours when labor market conditions are not in their favor.

4.4.1 Different Dependent Variables

Table 5 shows additional regression results at the same aggregation level as in Section 4.2, which help to evaluate whether these mechanisms play a role in the German labor market.

In the first column, we repeat the full specification from Table 2 (column 3) but add

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[31]See for example Heckman and MaCurdy (1980) and Mincer (1962).

[32]Mukoyama et al. (2019) find that direct transitions between part-time and full-time employment are decisive for the countercyclicality of part-time employment in the US.

Table 5: Different Dependent Variables, Regression Results

	(1) Share IVPT	(2) Number IVPT	(3) Share PT	(4) Share IVPT/PT
Unemployment Rate	0.245**	5.066***	-0.181	1.674***
	(0.0960)	(1.699)	(0.170)	(0.239)
Unemployment Rate Squared	-0.550***	-12.56***	-0.218	-2.799***
	(0.167)	(3.088)	(0.520)	(0.504)
Labor Force Participation	0.0146			
	(0.115)			
Demographic Group Shares	Yes	Yes	Yes	Yes
Industry Shares	Yes	Yes	Yes	Yes
GDP Growth	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
N= 256				

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Source: European Labour Force Survey and Eurostat.

the labor force participation rate. Labor market participation does not have any significant explanatory power. Neither does adding the additional variable change the effect of the unemployment rate to a relevant extent. There might be no significant "added worker effect". Another explanation might be that it is just compensated by a "discouraged worker effect", implying that groups which often work part-time involuntarily are discouraged in times of high unemployment and completely withdraw from the labor market.[33]

Column (2) presents a similar specification, but where the dependent variable is the absolute number of IVPT workers. The marginal effect of unemployment remains quite precisely estimated and positive in this case which is in line with the bargaining position effect: when the bargaining position of workers vis-à-vis employers worsens, the number of IVPT workers increases. This leads one to expect that the share of part-time in employment also rises when unemployment rises. We do not observe this as the coefficient of the unemployment rate is not significant in column (3). This is also an indication that transitions from full-time to part-time at the same employer are not the main driver of the positive association between unemployment and IVPT. However, the share of IVPT in part-time increases with unemployment (column 4), meaning that an increase in unemployment is not only associated with an increase in involuntary but also with a decrease in voluntary part-time work. The latter results from different mechanisms, as shown by investigating transitions

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[33]Buddelmeyer et al. (2004) name this as one of the relevant cyclical effects on part-time employment in general.

between different employment states in the next section: Unemployment induces the added hours effect, that is higher transitions from voluntary to involuntary part-time and to full-time.

4.4.2 Transitions

On the aggregate level, the results are indicative of a potential bargaining position effect and an added labor supply effect on the intensive margin ("added hours effect"). To investigate both in more detail, we look at transitions between different employment states (EMPST), precisely between the different employment forms involuntary part-time (IVPT), voluntary part-time (VPT) and full-time (FT) and the non-employment states unemployment (U) and non-participation (NE), and how these depend on labor market conditions. For this purpose we use Mikrozensus data from survey years 2012 to 2015 which can be combined to a panel data set.[34]

We calculate yearly transition probabilities between the five different states and relate them to regional unemployment in the initial year, formally speaking:

$$corr\left(U_{t-1}, P(EMPST_t | EMPST_{t-1})\right).$$

The bargaining position mechanism implies that workers are more likely to accept a part-time position despite preferring a full-time position when labor market conditions are not in their favor. This applies to both new hires, i.e. transitions from unemployment to employment, which more often result in IVPT, indicating that

$$corr\left(U_{t-1}, P(EMPST_t = IVPT | EMPST_{t-1} = U)\right) > 0,$$

as well as to existing employment relationships where IVPT workers are less likely to transition to full-time when unemployment is high, that is

$$corr\left(U_{t-1}, P(EMPST_t = FT | EMPST_{t-1} = IVPT)\right) < 0.$$

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[34]The German EU-LFS is based on the Mikrozensus, such that this data actually stems from the same source as our main data. Unfortunately, the Mikrozensus allows the construction of a panel only over four consecutive survey years. See Appendix A.2 for further information.

Figure 3: Bargaining Position Effect
Correlations between Unemployment in Previous Period and Transitions from Unemployment to IVPT (Left) and Transitions from IVPT to Full-Time (Right)
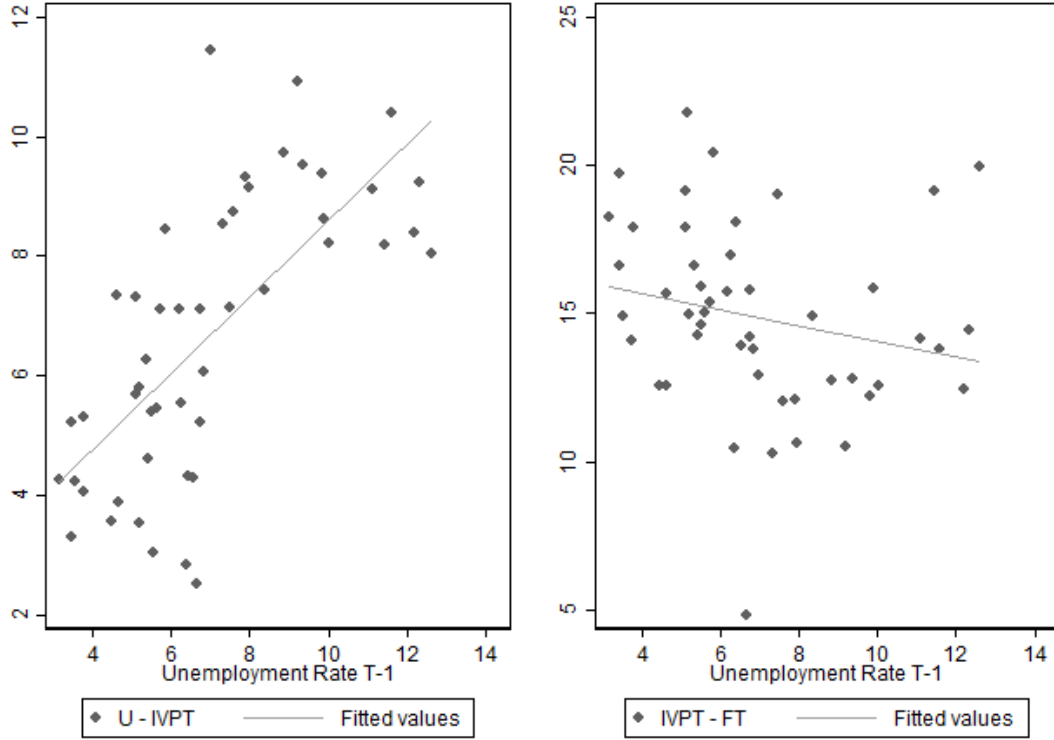
Figure 3 shows these transition probabilities and corresponding initial unemployment rates. They support the assumed mechanisms for the German labor market.

The added hours mechanism implies that part-time workers extend their labor supply in times of high unemployment. If they succeed, this leads to higher transition probabilities from voluntary part-time to full-time, that is

$$corr\left(U_{t-1}, P(EMPST_t = FT | EMPST_{t-1} = VPT)\right) > 0.$$

If they do not succeed, they will become involuntary part-timers, such that

$$corr\left(U_{t-1}, P(EMSPT_t = IVPT | EMPST_{t-1} = VPT)\right) > 0.$$

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Figure 4: Added Labor Supply Effect
Correlations between Unemployment in Previous Period and Transitions from Voluntary Part-Time to IVPT (Left) or to Full-Time (Right)
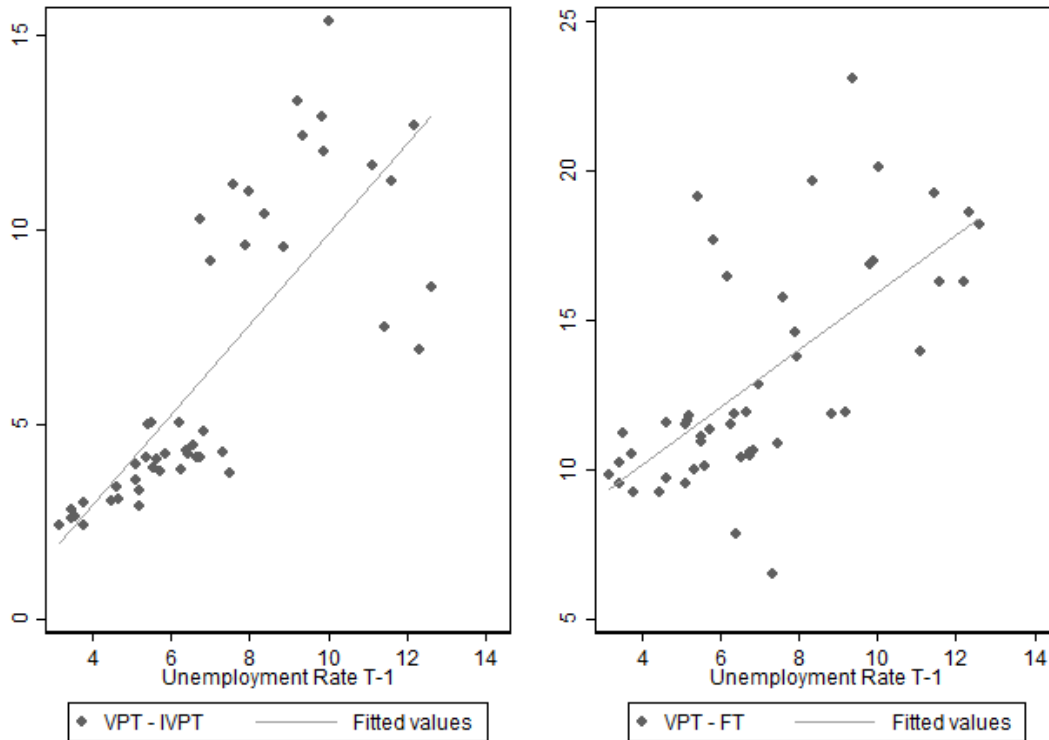
Again, the respective scatter plots, which are shown in Figure 4, suggest that both are the case. In fact, 85% of transitions from voluntary to involuntary part-time happen at the same employer, thereby reflecting changes in desired hours under presumably unchanged working circumstances.

Summarizing, the transition probabilities between the different relevant employment states are convincing indications that the association between unemployment and the incidence of IVPT stems from a shift in bargaining positions and from an extension of labor supply on the intensive margin.

5   Institutions and IVPT

Our analysis so far stresses the importance of institutions for the incidence of IVPT in Germany. As mentioned in Section 3.2, there are further institutional particu-

larities that might be worth controlling for as the association between IVPT and unemployment could in fact (also) be driven by changes in these particular forms of employment. Since labor market regulation is mandated at the national level, there are no relevant differences in regulation at the federal state level. However, the incidence of relevant forms of employment differs between federal states and over time. We again exploit within state variation to evaluate the influence of the share of marginally employed, the share of employees using working time accounts and the share of short-time workers. Adding the additional variables does not qualitatively change our findings from Section 4.2.

In 2003, the Hartz reforms expanded the possibilities to hire marginal employees, which means lower non-wage labor costs for the employer than for other employees (see Section 3.2). Some suspect that marginal employment has been used as a substitute for non-marginal employment. However, there has not been a clear trend in the use of marginal employment since the early 2000s and its role remains controversial (see for example Burda and Hunt 2011). A priori, the effect of the share of marginal employment on IVPT is unclear. A positive effect would be expected if a relatively large share of minijobbers was seeking full-time employment. However, it is also conceivable that minijobbers are satisfied with a small number of working hours or that they use an additional minijob to achieve the desired number of hours. We therefore differentiate between those who have a minijob in addition to a regular job and those who are exclusively marginally employed. The LFS does not include information on marginal employment as this is a form of employment specific to Germany. Therefore, we use administrative data from the Federal Employment Agency on the year and state specific shares of marginal employment and merge it with the LFS data.

Moreover, we control for the influence of working time accounts. If a firm uses working time accounts, the distribution of employees' working hours over the business cycle becomes more flexible. On the one hand, an increase in the spread of this instrument could lead to a heavier use of (involuntary) part-time as employers do not need to hire full-time employees to be able to use a certain number of working hours at a given time without paying overtime premia. On the other hand, employers might be more willing to employ full-time labor, when working time can be saved that is not needed at the moment. Again, the LFS does not provide information on working time accounts. We use data from the Socio-Economic Panel, a representative survey with about 30,000 respondents, to calculate the year and state specific shares of employees who use those accounts.

Table 6: IVPT and Particular Employment, Regression Results

Share IVPT	(1)	(2)	(3)	(4)	(5)
Unemployment Rate	0.264***	0.225***	0.236***	0.256***	0.249***
	(0.0718)	(0.0813)	(0.0711)	(0.0711)	(0.0728)
Unemployment Rate Squared	-0.582***	-0.463**	-0.486***	-0.555***	-0.523***
	(0.189)	(0.202)	(0.176)	(0.168)	(0.192)
Share Minijobbers (Excl.)	-0.0549				-0.0569
	(0.158)				(0.160)
Share Minijobbers (All)		-0.0548			
		(0.131)			
Share Working Time Accounts			0.0197***		0.0197**
			(0.00764)		(0.00780)
Share Short-Time Workers				-0.0476	-0.0397
				(0.120)	(0.113)
Demographic Group Shares	Yes	Yes	Yes	Yes	Yes
Industry Shares	Yes	Yes	Yes	Yes	Yes
GDP growth	Yes	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
AIC	0.2576771	0.2624766	0.2576709	0.2576771	0.2576699
N= 256					

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Source: European Labour Force Survey, Eurostat, Federal Employment Agency and
Socio-Economic Panel.

Lastly, we control for the incidence of short-time work using respective data from the Federal Employment Agency. As mentioned in Section 3.2, it cannot be predicted easily whether short-time work results in IVPT because this depends on employees' preferences regarding hours/wage combinations. As the incidence of short-time work is a rather countercyclical phenomenon overall (Balleer et al. 2016), it appears worth controlling for.

Table 6 shows the regression results using the full specification from before (structural variables and GDP growth are not shown), additionally including (1) the share of exclusively marginally employed, (2) the share of all marginally employed, (3) the share of employees using working time accounts, (4) the share of short-time workers and (5) variables (1), (3) and (4). Some of the variation in the incidence of IVPT can be attributed to the use of working time accounts. The positive marginal effect suggests that employers actually tend to use working time accounts instead of hiring full-time employees. The estimated influence of unemployment remains comparable in magnitude and significance to our findings from Section 4.2. The overall model fit improves once we include working time accounts.

6 Heterogeneity Analysis

In this section we analyze whether the effect of unemployment on IVPT varies in relevant dimensions: between Eastern and Western Germany, before and after the Great Recession or after the Hartz reforms. We find that the marginal unemployment effect is larger in Western Germany and that it has been larger since the Great Recession. Contrary to common belief, the Hartz reforms apparently did not increase the effect of unemployment on IVPT.

In Table 7, we report the results from different exercises that we further describe in the following. In each specification, we include year and state fixed effects and control for demographic group and industry shares as well as GDP growth. The first column of Table 7 shows the main results from Section 4.2 (specification (3) from Table 2) for a convenient comparison.

First, we investigate whether the association between IVPT and unemployment differs between Eastern and Western Germany. This is motivated by the observations presented in Section 3.3: There are substantial differences in the incidence of (in-voluntary) part-time work between the two regions, even though they have become smaller over time. As can be seen from Table 1, the share of IVPT is higher in Eastern Federal States, although the share of part-time work is generally lower. These differences have often been highlighted in the literature and are mainly attributed to different working time preferences of women: Not only is the labor market participation rate of women in Eastern Germany higher than in Western Germany, women in the East are also more likely to work full-time and are less likely to be content with part-time hours than women in the West (see for example Wanger 2011).

Figure 5: IVPT and Unemployment in Eastern and Western German Federal States
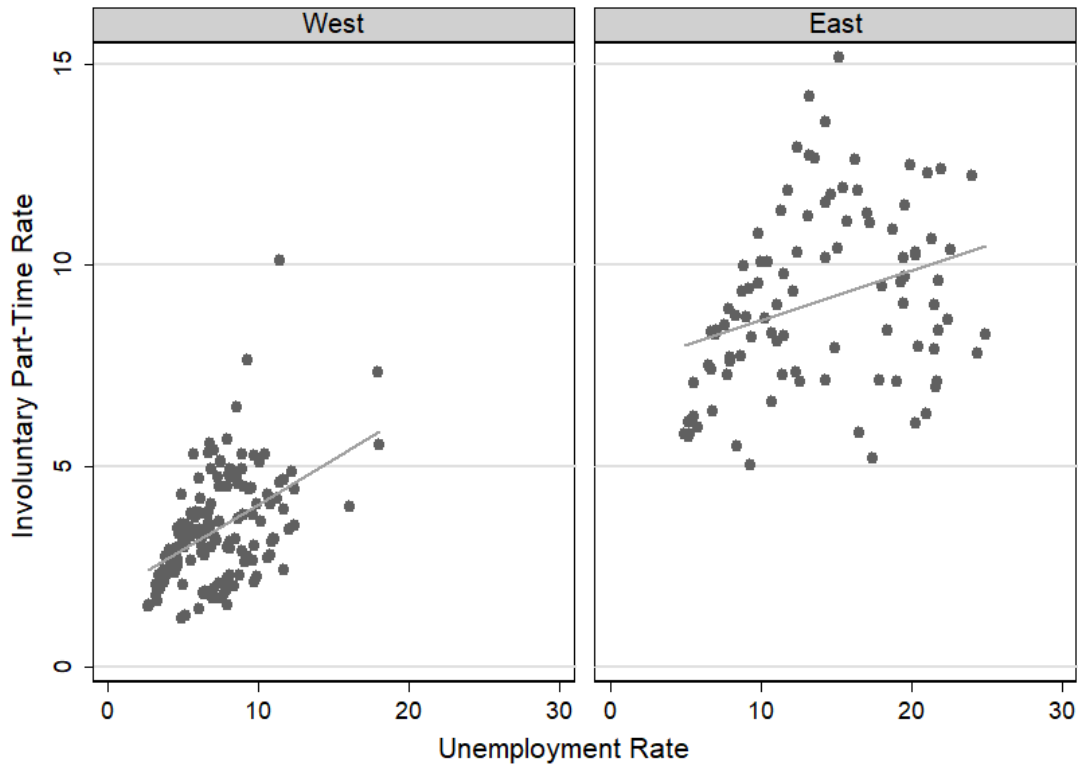
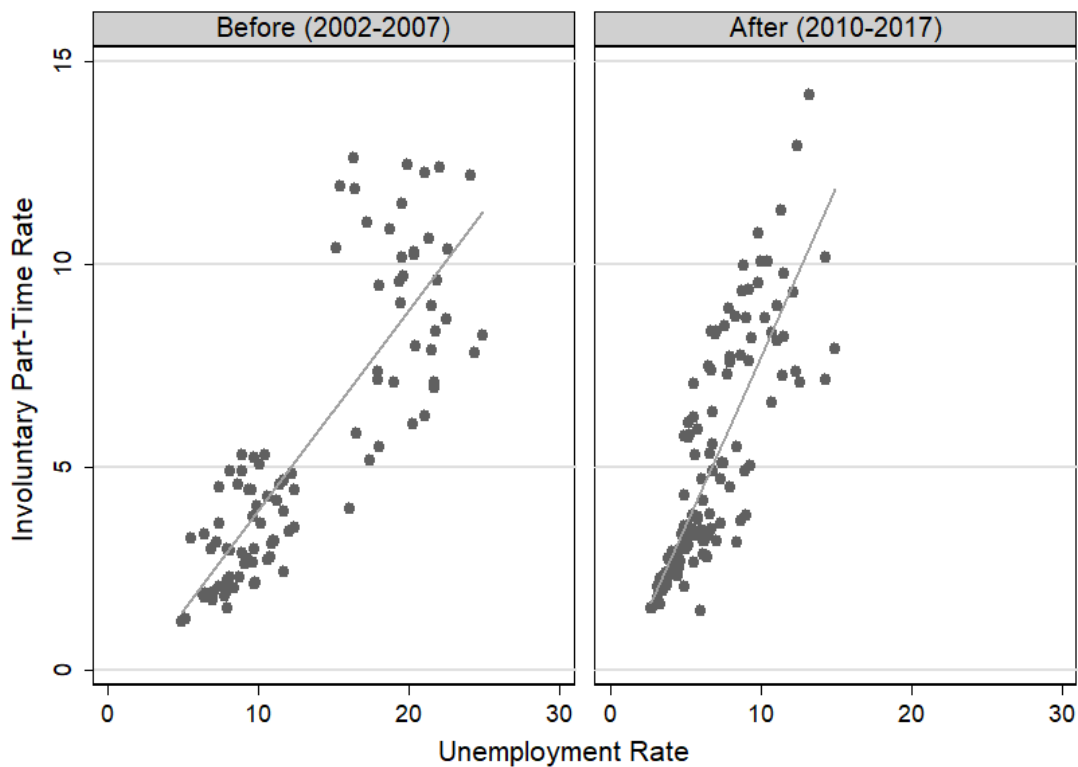Source: European Labour Force Survey and Eurostat, own calculations.

To inspect whether there are regional differences regarding the relationship between cyclical indicators and the incidence of IVPT we present some descriptive evidence in Figure 5. It shows the correlation between IVPT and unemployment separately for Eastern and Western German states. For both regions, there is a positive correlation between unemployment and IVPT, with the slope in Western Germany being steeper than in the East.

Column (2) of Table 7 confirms that there is a stronger relationship between unemployment and IVPT in Western Germany. In this specification, we interact unemployment with the distinction between Eastern and Western states. The marginal effect of unemployment on the incidence of IVPT is about twice as large in Western Germany than it is in Eastern Germany. This suggests that the relevant labor market mechanisms discussed in Section 4.4 affect the Western labor market more strongly. The result furthermore reflects the finding that the marginal effect of unemployment is generally decreasing: As the level of the unemployment rate is usually higher in Eastern Germany (see Figure 5), differences in the unemployment rates are less relevant for the incidence of IVPT. In other words, it seems that in

view of Eastern German employees' poorer situation, it does not matter as much how bad the situation actually is.

We now turn to potential differences between the periods before and after the Great recession. This distinction seems particularly relevant with regard to the literature: For the US labor market, Valletta et al. show that while the level of IVPT used to behave strongly countercyclically until the Great Recession, its recent development can be increasingly explained by structural factors. Here, we investigate whether there are differences in the cyclical dynamics of IVPT before and after the Great Recession in Germany as well.

Figure 6: IVPT and Unemployment Before and After the Great Recession

Source: European Labour Force Survey and Eurostat, own calculations.

Similar to Figure 5, Figure 6 shows the correlation between IVPT and unemployment separately for the periods before (2002-2007) and after (2010-2017) the Great Recession. The correlation appears to be slightly stronger after the Great Recession. Column (3) of Table 7 confirms that the impact of unemployment on the incidence of IVPT has actually been much stronger in recent years. In this specification, we interact the cyclical indicators with the distinction between the periods before and after the Great Recession. The marginal effect of the latter is more than twice as

Table 7: Heterogeneity, Additional Regression Results

Share IVPT	(1) FS from Section 4.2	(2) Eastern/Western Ger.	(3) Before/After GR	(4) After Hartz Reforms
Unemployment Rate	0.253***			0.186**
	(0.0695)			(0.0779)
Unemployment Rate Sq.	-0.550***			-0.433**
	(0.167)			(0.206)
Unemployment Rate West		0.578***		
		(0.124)		
Unemployment Rate Sq. West		-2.117***		
		(0.643)		
Unemployment Rate East		0.276***		
		(0.0759)		
Unemployment Rate Sq. East		-0.506**		
		(0.210)		
Unemployment Rate Before			0.167***	
			(0.0324)	
Unemployment Rate Sq. Before			-0.444***	
			(0.110)	
Unemployment Rate After			0.466***	
			(0.114)	
Unemployment Rate Sq. After			-2.231***	
			(0.622)	
Demographic Group Shares	Yes	Yes	Yes	Yes
Industry Shares	Yes	Yes	Yes	Yes
GDP growth	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
N	256	256	256	208

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
Source: European Labour Force Survey and Eurostat.

large. This could hint to a regime change in employers' hiring behavior after the recession. With the experience of the crisis, the same unemployment rate now leads to a higher rate of IVPT, implying either a shift in the bargaining positions or in workers preferences regarding full-time hours. This finding might also reflect the decreasing marginal effect of unemployment because unemployment rates have been much lower in recent years.

We furthermore examine whether our findings regarding the relationship between IVPT and unemployment depend on the Hartz reforms. These major reforms had various implications for the German labor market. As briefly outlined in Section 5, the Hartz reforms expanded, among other things, the opportunities for marginal employment ("minijobs"). However, the incidence of minijobs has no significant impact on IVPT, as shown in the same Section. Another relevant change was the reduction in unemployment benefits generosity: the payment period of income-dependent benefits was shortened, making unemployment a much worse option for employees since then. Theoretically, this suggests that unemployment has had a stronger influence

on the incidence of IVPT since the implementation of the Hartz Reforms.

We do not show separate scatter plots and do not use interaction terms to investigate this dimension, because there are too few observations before the Hartz reforms in our sample for them to be analyzed separately. Instead, we consider a separate sample that contains only observations after the Hartz reforms, that is from 2005-2017. The results are shown in column (4) of Table 7. In comparison to column (1), there are no qualitative differences. Contrary to the theoretic prediction, the effect is smaller when restricting the analysis to the period after the Hartz reforms. This result is consistent with other findings in the literature which show that the Hartz reforms did not have a the expected clear cut effect on atypical employment, including part-time, but rather reinforced the positive trend in a short transitory period right after the reforms.

7 Conclusion

In Germany, labor market regulation makes unilateral working hours reductions by employers rather difficult. This hampers the channel through which cyclical adjustment primarily takes place in other countries, e.g. in the US and the UK. However, in most sectors, the variation in IVPT can still be attributed to unemployment. We investigate the relevance of different channels through which higher unemployment could positively influence the share of IVPT. Our analysis suggests that the association mainly stems from shifts in bargaining positions over the business cycle and from extended labor supply on the intensive margin. It appears that the rather strict regulation of the German labor market does not prevent that high unemployment reduces the chances of employees realizing their desired full-time positions.

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A Appendix

A.1 Different Cyclical Indicators

In this part of the appendix, we separately consider different specifications of the model in order to gain some additional insights and to evaluate the robustness of our results. Specifically, we use different indicators to describe the state of the labor market and estimate different variants in each case. Summarizing, this exercise provides some interesting findings but does not produce any conflicting results.

Table A.1 shows the results. Again, state and year fixed effects are included in all specifications. Apart from that, we first only include the unemployment rate (column 1). We estimate a qualitatively similar but smaller effect on the incidence of IVPT than in our main analysis in Section 4. We find a more pronounced effect once we add the squared unemployment rate as an additional independent variable (column 2). As mentioned before, we thereby account for non-linear effects of unemployment. Again, we find a negative effect of squared unemployment, which indicates that the marginal effect of unemployment on the incidence of IVPT becomes smaller as unemployment increases. Controlling for demographic group and industry shares does not change the estimated effects much but increases the overall model fit substantially as shown by the within R^2 in column (3). Additionally adding GDP growth (column 4) also does not bring about any relevant changes. These findings could be expected given the comparison between the different specifications in Table 2 in Section 4.2.

We consider the lagged unemployment rate as a potential alternative explanatory variable in specifications (5)-(8). It is conceivable that certain effects of high unemployment will only become apparent in the following year. We find a significant positive effect of lagged unemployment once we account for its non-linearity in column (6). The negative effect of the squared term suggests a decreasing effect of lagged unemployment on the incidence of IVPT. Again, not much changes when controlling for demographic group and industry shares (column 7) and GDP growth (column 8). The positive effect of lagged unemployment suggests that unemployment is not only relevant for the incidence of IVPT as an indicator of current business conditions but that it also determines labor market outcomes in terms of IVPT in subsequent periods (for various possible effects of unemployment on the incidence of IVPT see Section 4.4).

In the literature, the employment-to-population ratio has been highlighted as an

interesting alternative measure to the unemployment rate, because when the US economy recovered from the Great Recession, the decline in unemployment did not go along with a correspondingly large increase in the employment-to-population ratio (see for example Bitler and Hoynes 2016). As emphasized above, the German unemployment rate barely responded to the crisis. This is similarly true for the German employment-to-population ratio. We nevertheless consider this ratio as an alternative explanatory variable in specifications (9)-(12). It does not have any significant effect.

Overall, considering different cyclical indicators provides some interesting insights. In particular, note that the influence of none of the indicators considered here depends on GDP growth which supports our focus on unemployment as the main cyclical indicator.

Table A.1: Different Cyclical Indicators, Regression Results

Share IVPT	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Unemployment Rate	0.0645**	0.273***	0.254***	0.254***								
	(0.0318)	(0.0659)	(0.0594)	(0.0639)								
Unemployment Rate Sq.		-0.592***	-0.546***	-0.545***								
		(0.201)	(0.154)	(0.162)								
Lag. Unemployment Rate					0.0361	0.320***	0.336***	0.329***				
					(0.0334)	(0.0613)	(0.0660)	(0.0686)				
Lag. Unemployment Rate Sq.						-0.785***	-0.797***	-0.783***				
						(0.166)	(0.182)	(0.187)				
Empl.-to-Pop. Ratio									-0.0450	0.228	0.615	0.661
									(0.0761)	(0.631)	(0.477)	(0.476)
Empl.-to-Pop. Ratio Sq.										-0.338	-0.855	-0.906
										(0.776)	(0.594)	(0.597)
Demographic Group Shares			Yes	Yes			Yes	Yes			Yes	Yes
Industry Shares			Yes	Yes			Yes	Yes			Yes	Yes
GDP Growth				Yes				Yes				Yes
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2 within	0.70	0.82	0.94	0.94	0.72	0.84	0.94	0.94	0.21	0.22	0.89	0.90
N= 256												

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Source: European Labour Force Survey, Eurostat

A.2 Data

In this section, we describe our different data sources. We primarily use yearly micro data from the European Labour Force Survey (LFS). However, additional data sources are needed for information on GDP growth and particular employment forms as well as for the calculation of transition probabilities in Section 4.4.2. Table A.2 provides an overview of our data sources.

For Germany, the European Labour Force Survey (LFS) provides cross-sectional information on about 830,000 respondents per year. Our main analysis covers the time period 2002 through 2017, as information on federal states ("Bundesländer") is crucial for our analysis and only available as of 2002 (variable *region*).

The LFS provides information on respondents' employment status. We use the variable *ilostat* which is based on the respective ILO definition[35] to determine whether respondents are employed or unemployed. We exclude all self-employed from our sample, using the variable *stapro*. Most importantly, the LFS allows for the identification of part-time workers (variable *ftpt*). This part-time measure is based on self-assessment. We further restrict our definition of part-time work to those who usually do not work more than 35 hours in total using the variable *hwusual*. Variable *ftptreas* determines whether we consider employees as involuntary part-time workers. Part-time employees are only considered as IVPT if *Could not find a full-time job* applies. If instead respondents state to work part-time for one of the following reasons, they are assumed to work part-time voluntarily: *Person is undergoing school education or training*, *Of own illness or disability*, *Looking after children or incapacitated adults*, *Other family or personal reasons* (from 2006) or *Other reasons*.

The LFS furthermore allows the assignment of employees to occupations and industries. For industries, we primarily use variable *na111d*, which is based on the NACE Rev 1.1 classification. As of 2009, the LFS provides information on respondents' industry only based on the newer NACE Rev. 2 classification. We use guidelines by the European Communities (2008, chapter 5) to translate this information into NACE Rev. 1.1 (on the one-digit level). We exclude respondents from our data set who are assigned to *Agriculture, hunting and forestry*, *Activities of households* or

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[35] *"Persons in unemployment or Unemployed population are defined as all those of working age who were not in employment, carried out activities to seek employment in a recent period (comprising the previous 4 weeks or month) and were currently available to take up employment (in the reference period or within a short subsequent period not exceeding two weeks in total)."* `https://www.ilo.org/global/statistics-and-databases/statistics-overview-and-topics/WCMS_470306/lang--en/index.htm`, accessed October 11th 2019.

Extra-territorial organizations and bodies. We use variables *is883d* (2002-2010) and *isco3d* (2011-2017) to identify occupations. Again, our analysis is based on the one-digit level. In line with the restriction relating to industries, we exclude respondents who are *Skilled agricultural, forestry and fishery workers.* The LFS also provides information on relevant socio-demographic characteristics. We use variables *age* and *sex* to define demographic groups.

For information on GDP, we use additional Eurostat data. We calculate regional GDP growth based on yearly GDP in Euros on German federal state level.

For the calculation of transition probabilities in Section 4.4.2, we use Mikrozensus data covering the time period 2012-2015. In general, this data comprises the same information as the LFS, because the German LFS data is collected from the Mikrozensus. However, unlike the LFS data, the original Mikrozensus data can be linked to a panel. This possibility exists for the years 2012-2015, but not for a longer time period.[36] We follow instructions by Herter-Eschweiler and Schimpl-Neimanns (2018) to longitudinally combine survey years 2012-2015. We use the same definitions for the different employment states as in the main analysis.

Additional information is required to assess the incidence of particular employment forms in Section 5. The Federal Employment Agency provides time series quarterly data on employees' characteristics by federal states ("Beschäftigte nach ausgewählten Merkmalen"), including information on the number of marginally employed. This data source allows to distinguish between those who have a minijob in addition to a regular job and those who are exclusively marginally employed. It only provides information on the incidence of marginal employment as of 2003. For 2002, we use data that is separately available from the Federal Employment Agency. Since marginal employment has only been allowed alongside another job since the Hartz reforms in 2003, this additional source only covers individuals who are exclusively marginally employed.

For information on short-time work, we also use data from the Federal Employment agency ("Angezeigte und realisierte Kurzarbeit"). We use the annual time series data on the actual number of short-time workers by federal states (as opposed to planned numbers which are often reported). This data covers all legal bases for claiming short-time work subsidies.

For the measurement of the incidence of working-time accounts, we rely on data from the Socio-economic panel (SOEP). This data set is based on an annual representative

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[36]Mikrozensus panel data is furthermore available for two additional periods which do not (1996-1999) / only partly (2001-2004) overlap with the time period of our main analysis.

Table A.2: Data sources

Source	Information	Period
European Labour Force Survey	Main data source, incl. information on employment states	1997-2017, mainly 2002-2017
Eurostat	GDP growth	1997-2017, mainly 2002-2017
Mikrozensus	Panel data on employment states	2012-2015
Socio-Economic Panel	Incidence of working time accounts	2002-2017
Federal Employment Agency	Incidence of marginal employment	2002-2017
Federal Employment Agency	Incidence of short-time work	2002-2017

survey of about 30,000 individuals in about 14,000 private households in Germany. Respondents who work overtime are asked whether their additional working time can be recorded in a working time account. For a discussion of data sources in which working time in Germany is covered see Zapf (2012).