

Additional File 1 to *Labor market regulation and the cyclicalty of involuntary part-time work*

Sectoral Analysis

From the literature it is well known that sectors are ~~differently~~-affected ~~differently~~ by cyclical developments (see for example Burda and Hunt 2011). By accounting for industry employment shifts in Section 4.1 of our paper, we do not cover sectoral differences in ~~labor market adjustments to cyclical developments~~dynamics. ~~In the following, we analyze the relevance of sectoral dynamics from two different angles. First, in the following,~~ we conduct the same analysis within industries. That is, we regress the regional involuntary part-time share within a specific sector on regional characteristics, including the regional unemployment rate and regional GDP growth. ~~Second, we account for interactions of structural variables with the national business cycle in our federal state level regression.~~

Table 1 shows the results ~~of the first exercise~~. 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 of our paper). 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 IPT 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 IPT 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.¹ Other reasons for high IPT in economic upturns could lie in expansions of labor

¹For Germany, e.g Kogan (2004) investigates labor market spells of immigrants against this background.

supply. If individuals who were previously satisfied with part-time jobs suddenly offer full-time hours, this will likely result in additional IPT. 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 IPT 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 our paper, we therefore focus on unemployment as the cyclical indicator of interest.

Another related question is whether the coefficient of the regional unemployment rate that we use as an indicator for local business and labor market conditions might also capture developments that are due to structural factors reacting differently to the nationwide business cycle. Analyses of the relationship between labor market developments and the economic cycle in other countries show that such links could exist, e.g. Bredemeier et al. (2023). To find out whether this is the case we conduct the following regression:

$$IPT_{st} = \alpha_s + \beta_t + \delta u_{st} + X_{st}\mu + X_{st}u_t\mu_2 + \varepsilon_{st}$$

where u_{st} is the regional unemployment rate and u_t is the national unemployment rate. Thus, we control for differences in the state-specific developments of involuntary part-time that are due to the structural factors reacting differently to nationwide business cycle developments within the federal states, with these being captured by $X_{st}u_t\mu_2$. In turn, the coefficient δ captures only the connection to involuntary part-time of fluctuations in unemployment that are unrelated to this differential exposure to the national business cycle. The results are shown in Table 2 below.

Column (1) corresponds to column (2) of Table 2 in our paper and column (2) refers to the new specification controlling for the interaction terms as explained above. As before, we include year and state fixed effects to capture any nationwide trends as well as time-invariant differences between states. When we add the interaction terms in column (2), only a few of them are significantly associated with the involuntary part-time rate. Importantly, the association between the unemployment rate and the involuntary part-time is still significantly positive even when we account for interactions between the structural control variables and nationwide business cycle developments.

References

- Bredemeier, Christian, Falko Juessen, and Roland Winkler (2023). “Sectoral employment effects of state fiscal relief: evidence from the Great Recession”. In: *Macroeconomic Dynamics* 27.4, pp. 998–1018.
- Burda, Michael C and Jennifer Hunt (2011). “What explains the German labor market miracle in the Great Recession?” In: *Brookings Papers on Economic Activity*.
- Kogan, Irena (2004). “Last hired, first fired? The unemployment dynamics of male immigrants in Germany”. In: *European sociological review* 20.5, pp. 445–461.

Table 1: 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** (0.0771)	-0.299** (0.136)	0.128 (0.143)	0.429** (0.196)	0.769 (0.571)	0.0534 (0.220)	0.474*** (0.104)	0.277 (0.199)	0.553*** (0.0957)	0.602** (0.241)	0.0382 (0.204)	0.728* (0.388)
Unemployment Rate Sq.	-0.613*** (0.231)	0.917** (0.389)	-0.0336 (0.405)	-0.687 (0.507)	-3.702*** (1.196)	-0.701 (0.626)	-1.108*** (0.246)	-0.428 (0.498)	-1.179*** (0.262)	-0.939 (0.595)	-0.0838 (0.585)	-1.680** (0.690)
GDP Growth	0.0589*** (0.0225)	0.0569 (0.0551)	0.153*** (0.0375)	0.0658 (0.0607)	0.0813 (0.109)	0.157* (0.0818)	0.00975 (0.0516)	0.109 (0.0731)	0.0438 (0.0566)	-0.148* (0.0846)	0.00445 (0.0873)	-0.117 (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												

Notes: Dependent variable is the share of IPT at federal-state x industry level in the years 2002-2017. Mean of state employment used for regression weights. Standard errors in parentheses clustered at federal states, $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Data sources: European Labour Force Survey and Eurostat, own calculations.

Table 2: Main regression including interaction of structural factors with national unemployment rate

	(1)		(2)	
Regional Unemployment Rate (u_{st})	0.251***	(0.0668)	0.341***	(0.0697)
Regional Unemployment Rate Sq. (u_{st}^2)	-0.549***	(0.160)	-0.688***	(0.263)
Women 17-26	0.0267	(0.122)	-1.115**	(0.493)
Women 27-36	0.00334	(0.134)	-0.445	(0.468)
Women 37-56	-0.0391	(0.131)	-0.270	(0.396)
Women 57-66	0.0250	(0.148)	-0.273	(0.496)
Women 67+	0.0787	(0.514)	1.331	(1.919)
Men 27-36	-0.180	(0.118)	0.167	(0.377)
Men 37-56	0.00757	(0.122)	0.423	(0.409)
Men 57-66	-0.0561	(0.149)	0.171	(0.501)
Men 67+	-0.283	(0.415)	0.551	(1.613)
Manufacturing	-0.0136	(0.0547)	-0.178**	(0.0905)
Electricity, Gas and Water	0.152*	(0.0840)	0.0293	(0.360)
Constrtuction	0.0405	(0.0474)	-0.0608	(0.189)
Wholesale and Retail Trade	0.136**	(0.0562)	-0.0128	(0.126)
Hotels and Restaurants	-0.0132	(0.105)	-0.118	(0.168)
Financial Intermediation	-0.0924	(0.0828)	-0.556***	(0.176)
Business Activities & Real Estate	0.0805	(0.0579)	-0.146	(0.146)
Public Administration & Defence	-0.0188	(0.0511)	-0.250*	(0.133)
Education	0.00455	(0.0787)	-0.184	(0.237)
Health and Social Work	0.00573	(0.0602)	-0.239	(0.166)
Other Services	0.0571	(0.0613)	0.243	(0.201)
$u_t \times$ Manufacturing			2.018**	(0.826)
$u_t \times$ Electricity, Gas and Water			0.243	(5.054)
$u_t \times$ Constrtuction			0.787	(2.706)
$u_t \times$ Wholesale and Retail Trade			1.478	(1.380)
$u_t \times$ Hotels and Restaurants			1.036	(2.105)
$u_t \times$ Financial Intermediation			5.993***	(2.232)
$u_t \times$ Business Activities & Real Estate			2.999	(2.040)
$u_t \times$ Public Administration & Defence			2.771*	(1.441)
$u_t \times$ Education			2.523	(3.114)
$u_t \times$ Health and Social Work			2.924	(2.568)
$u_t \times$ Other Services			-2.084	(2.361)
$u_t \times$ Women 17-26			17.51***	(6.759)
$u_t \times$ Women 27-36			4.781	(7.562)
$u_t \times$ Women 37-56			3.328	(4.552)
$u_t \times$ Women 57-66			4.687	(7.570)
$u_t \times$ Women 67+			-16.47	(28.69)
$u_t \times$ Men 27-36			-3.570	(5.916)
$u_t \times$ Men 37-56			-5.828	(6.117)
$u_t \times$ Men 57-66			-4.193	(7.323)
$u_t \times$ Men 67+			-12.92	(25.85)
State Fixed Effects	Yes		Yes	
Year Fixed Effects	Yes		Yes	
N = 256				

Notes: Dependent variable is the share of IPT at federal-state level in the years 2002-2017. Mean of state employment used for regression weights. *Men 17-26* is omitted demographic group, *Transportation, Storage and Communication* is omitted industry category. Standard errors in parentheses clustered at federal states, $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Data sources: European Labour Force Survey and Eurostat, own calculations.