

# The Labor Demand Side of Involuntary Part-time Employment \*

Hyeri Choi<sup>†</sup>      Ioana Marinescu<sup>‡</sup>

December 19, 2022

## Abstract

Involuntary part-time employment is a measure of labor market slack that goes beyond the unemployment rate and broadens our understanding of the state of the labor market. Our study examines the determinants of involuntary part-time employment rates by accounting for both supply and demand channels of the labor market. We investigate the role of labor demand by focusing on job vacancies, and labor supply by focusing on unemployment. We use big data on the near universe of online job vacancies collected by Burning Glass Technologies, and the Current Population Survey from 2003 to 2021. We find that, within the commuting zone by 6-digit SOC cell, a ten percent increase in unemployment rate increases the share of involuntary part-time rate by 0.19 percentage points, while a ten percent increase in job vacancies decreases the share of involuntary part-time rate by 0.07 percentage points. Overall, we conclude that higher labor supply and lower labor demand increase involuntary part-time employment. We also provide suggestive evidence that labor market power as measured by labor market concentration may additionally increase involuntary part-time employment. Our study shows that workers are more likely to have their preferred work hours when there are more employers that they can work for.

\*We are grateful to the Alfred P. Sloan Foundation [Grant G-2021-14117] for their support, and conference audiences who attended APPAM 2022 for their thoughtful comments, suggestions, and support.

<sup>†</sup>University of Pennsylvania, School of Social Policy and Practice. [hyerchoi@upenn.edu](mailto:hyerchoi@upenn.edu)

<sup>‡</sup>University of Pennsylvania, School of Social Policy and Practice and NBER. [ioma@upenn.edu](mailto:ioma@upenn.edu)

# 1 Introduction

Involuntary part-time employment is a measure of labor market slack that goes beyond the unemployment rate and broadens our understanding of the labor market during a recession. According to the Bureau of Labor Statistics (BLS), workers are classified as part-time workers for economic reasons or involuntary part-time workers if they work fewer than 35 hours per week at all jobs, want to work full-time, but cannot find a full-time job due to poor economic conditions. Constraints may arise primarily on the employer or demand side of the labor market (Finnigan, 2018). Recessions reduce job opportunities, forcing workers to take part-time jobs they do not desire. However, existing research has mostly focused on the characteristics and behavior of involuntary part-time workers, not on employers' choice to use part-time workers (Blank, 1989, 1990; Caputo and Cianni, 2001; Lester, 1996; Miller, 1997; Pech et al., 2021). In this paper, we investigate the role of labor demand by focusing on job vacancies. We use big data on the near universe of online job vacancies collected by Burning Glass Technologies and the Current Population Survey from 2003 to 2021.

The presence of involuntary part-time employment indicates that an economy is unable to provide work hours or jobs that workers desire. Unlike voluntary part-time workers who choose to work part-time because of family obligations or other personal reasons, involuntary part-time workers are those whose hours are being constrained by their employers. Employers can cut back hours as an adjustment channel to various shocks (Borowczyk-Martins and Lalé, 2020). Moreover, involuntary part-time employment deepens inequality in the labor market because it disproportionately affects African Americans and Hispanics, recent immigrants, and less-educated workers (Golden and Kim, 2020; Valletta et al., 2020). These workers are more likely to work in low-wage settings that have unstable work hours and live in poverty (Finnigan, 2018; Golden and Kim, 2020). Reducing work hours not only results in involuntary part-time workers losing income and benefits, but also in the economy's loss of potential goods and services. Thus, the involuntary part-time work negatively affects disadvantaged workers and has knock-on effects on the broader economy.

Current literature suggests three reasons for the prevalence of involuntary part-time employment: cyclical factors (Borowczyk-Martins and Lalé, 2019), structural factors such as type of industry (Valletta et al., 2020), and employee benefits such as health insurance (Even and Macpherson, 2019; Dillender et al., 2022). However, these factors do not fully explain involuntary part-time work. Job vacancies are another factor that can influence involuntary part-time employment. The unemployment rate has long been used as a measure of the health of the labor market, but search-and-matching models highlight the importance of job openings in addition to unemployment rate (Abraham et al., 2020; Yashiv, 2007).

When the labor market is tight with many job vacancies, workers have more options in the external labor market to choose the job they desire. A small body of research showed the growing demands of part-time work for scheduling flexibility or a workforce that commands lower compensation, but the role of job vacancies was not examined (Tilly, 1991; Even and Macpherson, 2019). Although the traditional supply and demand framework has been used to explain the increase of part-time work (Euwals and Hogerbrugge, 2006), to our knowledge, no US studies directly examined the role of job vacancies in understanding involuntary part-time employment.

Our study examines the determinants of involuntary part-time employment by using an empirical framework that accounts for both supply and demand channels of the labor market. According to the classic supply and demand model, involuntary part-time employment occurs when the number of people who prefer full-time over part-time (supply) exceeds the number of full-time jobs offered (demand) in the labor market. We investigate the role of labor demand by focusing on job vacancies and the role of labor supply by focusing on unemployment.

We use the Current Population Survey (CPS) and data on all online vacancies from Burning Glass Technologies (BGT), encompassing two recent recessions. The CPS-BGT merged data consists of more than 650,000 geography-occupation-year-quarter observations, covering the period of 2003Q1-2021Q2. Our analytic sample from CPS-BGT merged data has limited county information as CPS does not reveal all county information to preserve respondents' confidentiality. However, our sample still represents 61.5 percent of the total U.S. population. We use market-level panel regressions with ordinary least squared (OLS) models and conduct several robustness checks.

To preview the findings, our results indicate that higher labor demand as measured by the number of job vacancies decreases the incidence of involuntary part-time employment. Within the commuting zone by 6-digit SOC cell, a ten percent increase in job vacancies is associated with a 0.07 percentage point decrease in the share of involuntary part-time employment (a 1.63% decrease off of an average IPT of 4.3%). Also, we show a positive relationship between involuntary part time employment and unemployment. A ten percent increase in the unemployment rate is associated with a 0.19 percentage point increase in the share of involuntary part-time employment (a 4.41 % increase off of an average IPT of 4.3%).

Overall, we conclude that higher labor supply and lower labor demand both increase involuntary part-time employment. We also provide suggestive evidence that labor market power as measured by labor market concentration may additionally increase involuntary part-time employment. Our study shows that employers' behavior is important to understand involuntary part-time employment.

The studies that are closest to ours include [Borowczyk-Martins and Lalé \(2019, 2020\)](#) and [Valletta et al. \(2020\)](#). These studies examined the cyclical and structural determinants of involuntary part-time employment. Our study builds on to these studies by considering both the cyclical movements (unemployment rate) and structural factors (occupation and demographic compositions) into our analyses. In contrast to [Borowczyk-Martins and Lalé \(2020\)](#), we focus on the external labor market using job vacancy rather than intensive margin of labor adjustment. [Borowczyk-Martins and Lalé \(2020\)](#) insist that the cyclical movement of involuntary part-time employment is mostly driven by within employment reallocation. Even if the internal labor market plays an important role, job vacancies affect the prevalence of involuntary part-time work because they increase workers' outside options. When the labor market is tight, workers may choose to change jobs in response to a reduction in their working hours.

Finally, our study adds to the literature on labor market power ([Marinescu and Rosenfeld, 2022](#); [Azar et al., 2020, 2019](#); [Marinescu and Hovenkamp, 2019](#)). A low-wage worker's economic advancement is primarily dependent on two factors: switching to a higher-paying job or improving their current job's pay ([Marinescu and Rosenfeld, 2022](#)). Similarly, involuntary part-time workers may advance their well-being either by changing to a full-time job or increasing their work ours at their current jobs. Both options require an increase in worker power. Therefore, examining employers' labor market power over workers' is essential. Labor market is concentrated when a few firms dominate hiring in the market and have high labor market power ([Azar et al., 2020](#)). Employers with monopsony power tend to lower employment and wages and constrain work hours relative to what would occur in competitive labor markets ([Arnold, 2019](#); [Azar et al., 2019](#); [Marinescu and Hovenkamp, 2019](#)). When the labor market power decreases - many employers providing available jobs and competing with one another - workers have more choices and their job quality increases, as measured by their part-time status. Accordingly, we investigate whether labor market concentration is associated with involuntary part-time employment. We measure concentration as the Herfidahl-Hirschman Index over job vacancies at the market level (commuting zone by 6-digit SOC occupation). Even after accounting for the number of job vacancies, lower employer concentration is associated with a lower prevalence of involuntary part-time work.

In sum, our study builds on and contributes to several strands of the literature. Our study adds the dimensions of labor demand to our understanding of involuntary part-time work by including job vacancy to the analysis. To our knowledge, this is the first study to directly examine the role of job vacancy in involuntary part-time employment. Furthermore, our study investigates the underlying causes of high involuntary part-time employment rates

on both workers' and employers' sides.

The remainder of the paper is organized as follows. Section 2 describes our conceptual framework of the study. In Section 3, we describe our data, measurements, and analytic approach. Section 4 presents our results and Section 5 provides discussion and concluding marks.

## 2 Understanding Involuntary Part-Time Employment: A Conceptual Framework

Individuals work part-time for various reasons. According to the Bureau of Labor Statistics (BLS), people work part-time either because 1) they cannot find full-time work because of poor economic conditions, or 2) because of family obligations or other personal reasons. Workers who identify the former reason as their main reason for working part-time are considered Involuntary Part-Time (IPT) workers or part-time workers for economic reasons and the latter are considered as Voluntary Part-Time (VPT) workers or part-time workers for noneconomic reasons. Voluntary part-time workers work less than full-time “by choice” unlike involuntary part-time workers who preferred to have a full-time job but could only find a part-time work. Therefore, according to this definition, a difference between and voluntary part-time workers is the “preference” for a part-time job.

We can divide the driving forces of involuntary part-time employment into three categories: cyclical factors, structural factors such as type of industry, and workplace policies such as employee benefits (i.e., health insurance). First, involuntary part-time is strongly countercyclical and predominantly explained by cyclical changes ([Borowczyk-Martins and Lalé, 2019](#)). During economic downturns, employers may decide to engage in labor hoarding by reducing the hours of currently employed rather than laying them off to save hiring and training costs in future years. Second, some industries are more likely to employ part-time workers. For instance, part-time work is especially high among service industries such as retail, leisure, and hospitality ([Valletta et al., 2020](#)). Third, employee benefits for full-time workers are a labor cost that can be avoided by employing workers part-time. Studies showed that involuntary part-time employment increased especially in retail and food service industries since the passage of the Affordable Care Act employer mandate<sup>1</sup> in 2014 ([Dillender et al., 2022](#); [Even and Macpherson, 2019](#)). In addition to these factors, we examine job vacancy and labor market concentration as the labor demand side of the involuntary part-time

---

<sup>1</sup>The Patient Protection and Affordable Care Act (ACA) employer mandate requires employers with at least 50 full-time-equivalent employees to offer health insurance to employees working 30 or more hours per week.

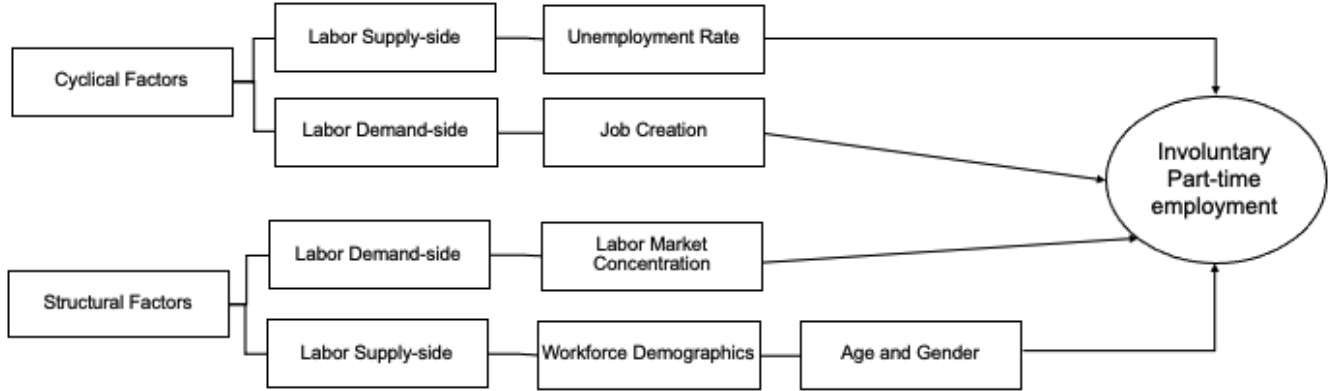
employment to explain this phenomenon.

The framework used to model unemployment and job vacancy throughout this work is the classic supply and demand model (Holt and David, 1966). Figure 1 presents various factors influencing involuntary part-time employment. Cyclical factors are changes in labor demand or supply occurring at a business cycle frequency. Both unemployment rate and job vacancy are considered as a measurement to assess the degree of labor market slack in the broader economy overtime. The unemployment rate is the fraction of the labor force that does not have a job but is actively searching for one. Thus, counts of the number of job seekers, unemployed or otherwise, reflect the labor supply. Also, employers seek workers which is reflected in the number of job postings. As a result of friction between workers' search and employers' hiring practices, individuals will be pulled off their labor supply curves, leading to labor market underutilization or involuntary part-time employment – a gap between their desired and actual work hours in the economy (Faberman et al., 2020).

Market/Structural Factors are persistent changes in demand and supply conditions rather than the variation at a business cycle frequency. Structural factors include industry structure and labor costs which are the demand-side and workforce demographics which is the supply-side (Valletta et al., 2020). Due to a peak-load pattern, certain industries, such as retail and the hospitality and leisure sector, tend to hire more part-time workers no matter whether unemployment is high or low. Thus, if these industries expand as a share of the economy, it will increase involuntary part-time employment (Borowczyk-Martins and Lalé, 2019; Valletta et al., 2020). Employer market power can be either cyclical or structural, but based on our analysis, labor market concentration did not vary that much in general. So, it is classified as a structural component in our framework.

We will examine the prevalence of part-time employment both among workers and among job vacancies, which helps us understand both the supply and demand factors behind the phenomenon. Involuntary part-time employment occurs when the number of people who prefer full-time over part-time (supply) exceeds the number of full-time jobs offered (demand) (Valletta et al., 2020). Thus, we expect to see a positive effect of unemployment rate and a negative effect of job vacancy on the involuntary part-time employment.

Figure 1. Our Conceptual Framework



Notes: Constructed by the authors based on current literature

### 3 Research Design and Methods

#### 3.1 Research Design and Methods

We use the Current Population Survey (2003-2021), and data on all online vacancies from Burning Glass Technologies (2007 to 2021).<sup>2</sup> We keep an unbalanced panel of 657,143 geography–occupation–year–quarter observations, covering the period 2003Q1–2021Q2, 191 commuting zones, and 200 SOC six-digit occupations. We mainly use panel regression with market and time fixed effects. Market is defined as a SOC-6 occupation by commuting zone by quarter. We conducted several robustness checks. We implemented specifications without vacancy weights, with employment weights, with alternative unemployment measures, with labor market concentration using OLS and IV strategies, with union-related covariates, with separate CZ and SOC fixed effects, using individual logit regressions, and using fractional logit models.

<sup>2</sup>One might be concerned that the BGT measurement of job vacancies during the Great Recession period (2007-2010) is under-reported. The Great Recession period data may not reflect the full effects of the job vacancies. Thus, we conducted a sensitivity analysis with a model from 2011 to 2021, excluding the Great period. The results are similar to estimates from the main analysis.

## 3.2 Data Description

### 3.2.1 Current Population Survey - Basic Monthly files (BM)

We use the Current Population Survey (CPS) from 2003 to 2021. We restricted our dataset to 2003 and forward to focus on around the two recent recessions: the US Great Recession and COVID-19 Recession. Also, there was a major revision of occupation category in the 2002 Census occupation and industry classification system which was applied in 2003 ([Bureau of Labor Statistics, 2022a](#)). Thus, to focus on the recent recessions and avoid major influences of changes in occupational category, our CPS sample is restricted to 2003-forward. The CPS micro data contains information on hours worked, full-time job preference, earnings, and worker characteristics. The CPS sample consisted of 29,592,026 individuals, 414 counties, and 719 occupations throughout 2003-2021. From the CPS data, we measure involuntary part-time employment and demographic characteristics.

It is important to note that counties with population less than 100,000 are not identifiable in the CPS micro data to preserve respondents' confidentiality.<sup>3</sup> About 45 percent of households in recent years are located in a county that is identified ([Flood et al., 2022](#)). As the nation's largest household survey, the American Community Survey (ACS) provides a range of information at the county level, but do not have information on involuntary part-time employment.

### 3.2.2 Burning Glass Technologies (BGT) data

We use data on all online vacancies from Burning Glass Technologies (BGT) from 2007Q1 to 2021Q2 (2008 and 2009 data are not available). The company collects and deduplicates job postings from about 40,000 websites, which constitutes most of the US job vacancies posted online. Job postings on BGT tend to be skewed towards more highly skilled occupations ([Hershbein and Kahn, 2018](#)). However, when BGT data are compared with official data on employment (i.e., U.S. Occupational Employment Statistics, Job Opening and Labor Turnover Survey (JOLTS)), it exhibits good representativeness at the occupational level as well as industry level ([Cammeraat and Squicciarini, 2021](#); [Hershbein and Kahn, 2018](#)). BGT data has been widely used among scholars to understand the labor market demands, occupational skills, and wages ([Azar et al., 2020](#); [Faryna et al., 2022](#); [Ghoshsamaddar et al., 2021](#); [Hershbein and Kahn, 2018](#)).

Based on the job postings, the BGT company cleaned the data by removing vacancy duplicates and extracting essential characteristics for each vacancy such as occupation and

---

<sup>3</sup>We checked the restricted data provided by BLS and U.S. Census Bureau, but no data were available for our analysis at the county level. County level data was only available at the ASEC march data.



industry identifiers, geographic information, credentials and requirement, and salary and job type. From BGT data, we measure the number of vacancies for each firm and identify the location and occupation of each vacancy. Before any sample construction, BGT sample consisted of 431,422 markets with 903 CZ and 836 six-digit SOC. This leads to a total of 9,308,224 observations by CZ-SOC, and YQ (market-period level data).

### 3.2.3 CPS-BGT merged data: Sample Construction

We construct our final analytic sample by merging the BGT and CPS datasets by occupational and geographic dimensions. Our data merging process is as follows. First, from BGT data, we extracted number of vacancies, CZ, SOC<sup>4</sup>, employer ID, job type (part-time or full-time), and job posting data. Then, the data was collapsed by CZ, SOC, and YQ. BGT used SOCs based off of the most recent 2018 SOC delineations. Second, from CPS data, we constructed involuntary part-time employment, unemployment, and demographic variables. We also extracted occupation (census codes), survey date (year and month), geographic information (state, county). Third, to create common identifiers across two databases, we used county-commuting zone crosswalk and OCC-SOC crosswalk. SOC-6 is more disaggregated than the census OCC. Thus, to match the census occupation code with SOC, some SOC-6 was aggregated at the SOC-5 level (i.e., OCC=630 including SOC=13-1071, 13-1074, 13-1075 were coded as 13-1070). Thus, although we use “SOC” variable as the common identifier, our study relies more on the census occupation classification system. Then, by CZ, SOC, and YQ, we merged the CPS and BGT dataset. This process allowed us to match approximately 18,000-21,000 labor markets for each year in BGT. Before we aggregate the data at the market level, the sample includes 4,541,751 individuals.

Finally, we restrict our sample to the top 200 occupations since a market by CZ and six-digit SOC might be too narrow to ensure enough observations for each market. We note that this decision results in higher job vacancies within a market than if we had included all occupations. This leaves us with 6,215 firms that together posted 27,363 vacancies during our observation period. The total number of markets (6-digit SOC occupation by commuting zone) we consider in our main analysis is 31,465 (191 CZ-200 six-digit SOC) and 657,143 observations. This comprises our final sample used throughout the rest of our analyses.

---

<sup>4</sup>BGT uses 2010 SOC classification system.

### 3.3 Definition and Measures

#### 3.3.1 Labor market: Time, Occupation, and Geography

We define our labor market as a SOC-6 occupation by commuting zone by quarter. A geographic dimension of the market is commuting zone in our study. Commuting zones are cluster of counties based on commuting patterns to understand local economics and local labor markets (Azar et al., 2020). Our occupational dimension is defined by six-digit SOC since narrower definition of a labor market is a better measurement of the local labor market. Finally, our market is observed at the quarterly level as the median duration of unemployment ranges between 8 and 13 weeks in 2022 (Bureau of Labor Statistics, 2022b). Also, quarterly data provides a richer description of short-run fluctuations.

#### 3.3.2 Involuntary Part-time Employment Rate

We define the involuntary part-time rate as the share of involuntary part-time workers in total employment (Valletta et al., 2020). This is also measured at the SOC-6 occupation by commuting zone by quarter level. We rely on the self-reported data using CPS and calculate involuntary part-time employment by identifying workers whose usual hours were under 35 at all jobs and who responded that they wanted to work full-time but could not to do so due to slack business/could not find a full-time job.

According to BLS, part-time workers are categorized by the reason they work part-time—economic or noneconomic based on the following question in the CPS survey:

*Some people work part time because they cannot find full time work or because business is poor. Others work part time because of family obligations or other personal reasons. What is (name's/your) MAIN reason for working part time?*

To be classified as involuntary part-time workers, a part-time worker must both want and be available to work full-time, and identify one of the following reasons as the main reason that they work part-time: slack work/business conditions, could only find part-time work, seasonal work.

#### 3.3.3 Number of Job Vacancies

Our primary measure of labor demand is the number of job vacancies posted by each firm. We define job vacancies at the market level as a weighted average of occupation by commuting zone; we use the logarithm of job vacancies as in prior literature to account for the skewness of this variable. The baseline is calculated using commuting zones for the geographic market definition, 6-digit SOC codes for the occupational market definition, aggregating the data

at the quarterly level.

$$VAC_{mt} = \sum_{j=1}^J P_{jmt} \quad (1)$$

$P_{jmt}$  is the number of job postings of firm  $j$  in market  $m$  at time  $t$ .

### 3.3.4 Unemployment Rate

We measure unemployment rate at the county level by using county unemployment data from Local Area Unemployment Statistics (LAUS). By using commuting zone and county crosswalk, we merged county unemployment rate with our market level analytic sample. Since there are multiple counties within a commuting zone, we averaged the county unemployment rate by commuting zone. Instead of measuring the unemployment rate at the market level, we use county information because some markets showed 0 or 1 unemployment rates due to a narrow definition of the market. We conducted sensitivity analysis using other geographical areas for our unemployment rate instead of commuting zones (Appendix C).

## 3.4 Empirical Strategy

We use market-level panel regressions for this analysis. We estimate the following equation:

$$IPT_{mt} = \beta_1 VAC_{mt} + \beta_2 U_{mt} + \gamma X_{mt} + \alpha_t + \delta_m + \epsilon_{mt} \quad (2)$$

Where  $IPT_{mt}$  is the involuntary part-time rate in market  $m$  and period  $t$ .  $VAC_{mt}$  is the log number of job vacancies and  $U_{ct}$  is the unemployment rate in commuting zone  $c$ .  $X_{st}$  is a set of persistent structural features of labor markets that affect the IPT rate such as demographic compositions (labor force shares by age group and gender) in the market,  $\alpha_t$  is a year-quarter fixed effect, and  $\delta_s$  is a market fixed effect.  $\epsilon_{st}$  is the error term. We cluster standard errors at the market level. Observations are weighted by each market's average number of job vacancies over the sample period. Thus, vacancy weights are cross sectional, not time varying.

We first run the baseline specification with no controls, and then add market and year-quarter fixed effect sequentially. We add market and year-quarter fixed effects to control for any possible changes in the characteristics of the commuting zone or the occupation over time. Then, we add unemployment rate and structural factors sequentially. Based on our conceptual framework and prior literature, we expect a negative  $\beta_1$  coefficient and a positive  $\beta_2$  coefficient. Our analysis is a descriptive regression analyses to understand what predicts involuntary part-time rates and does not aim at establishing a causal relationship.

### 3.5 Empirical or Measurement Limitations

Several measurement limitations remain in our study. First, it is important to note that our analytic sample merged BGT data with CPS data where counties are not fully identified to preserve respondents’ confidentiality. Therefore, our results, while fairly general, do not necessarily apply to the whole U.S. labor market. Within the confidentiality restrictions, we indicate 191 commuting zones and 411 counties in our sample which represent 61.5% of the total U.S. population. Although we lack full county information, our analytic sample still represents the majority of the total U.S. population. Second, due to a narrow labor market definition, some unemployment rates at the market level were 0 or 1. Accordingly, we used unemployment rate at the commuting zone level while other main variables were at the market level. However, according to our sensitivity analysis with state, CZ, and market unemployment rate, the effect of job vacancies on involuntary part-time employment remains robust (Appendix C).

Lastly, it would be more accurate to measure the number of full-time or part-time job vacancies to see if it is really the “full-time” job that is hard to find. However, in the BGT data, there are many missing values for part-time and full-time job status. For example, 64% of work hours information were missing in 2007Q1. With limited information, we provide evidence that full-time job vacancy is negatively associated with involuntary part-time employment. Additional full-time job vacancies are likely to decrease involuntary part-time employment but with a smaller magnitude than the coefficients on job vacancies (Appendix D).

## 4 Results

### 4.1 Descriptive Results

Table 1 presents summary statistics for the main variables used in our analysis over the whole sample period (2003Q1-2021Q2). The average market in our sample has 222 job vacancies, which is higher than vacancies over the period 2010Q1-2013Q4 measured in [Azar et al. \(2022\)](#). On average, 4.3 percent of the total employed U.S. workers are involuntary part-time, and 6.3 percent of the total labor force are unemployed.

Involuntary part-time workers tend to be young, as 23.7 percent of them are age 16-24.<sup>5</sup> Also, the table shows substantial variation across broad industries and occupations in the share of involuntary part-time employment. Involuntary part-time work are high in selected

---

<sup>5</sup>We examined the heterogeneous effects of gender and race on involuntary part-time employment at the individual level. As the prior literature suggests, we confirm that being women and Black increases the probability of being involuntary-part-time workers.

service or retail industries such as leisure and hospitality (19.9%), retail trade (18.4%), and education and health services (13.6%). For occupations, services (32.7%) and sales related (13.3%) jobs showed high incidence of involuntary part-time employment.

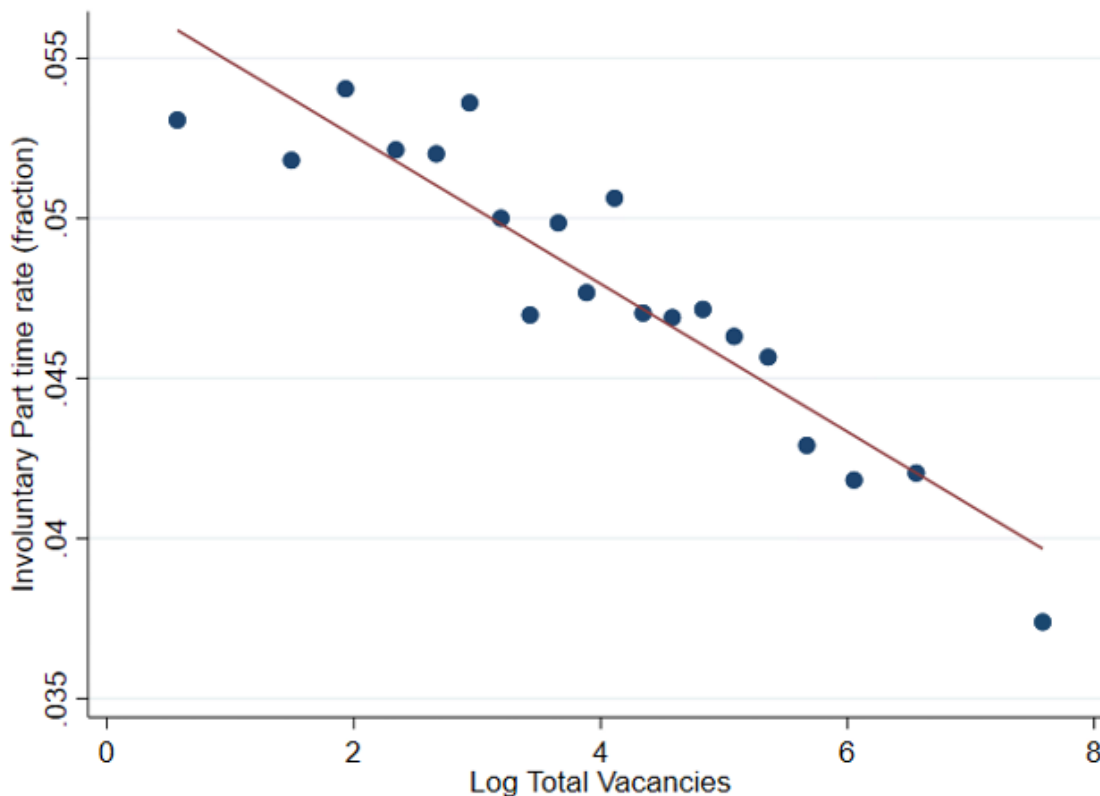
Figure 2 illustrated the relationship between involuntary part-time employment and job vacancy with a binned scatter of the involuntary part-time employment rate by log total job vacancies. We see that the relationship is roughly linear in logs showing that markets with higher job vacancies having lower involuntary part-time rate. This is a raw relationship, and our regression analysis will be accounting for potential confounds.

Table 1. Summary Statistics of Major Variables in the Study Over the Sample Period (2003-2021)

Measures	Percentage or mean	SD	Minimum	Maximum
<b>Market level</b>				
<b>Total Vacancies</b> (CZ-SOC whole period)	222.6289	642.3288	1	27,363
<b>Unemployment</b> (CZ whole period)	0.063 (6.3%)	0.0258	0.021	0.272
<b>Individual level</b>				
<b>Involuntary part-time employment</b>	0.042 (4.3%)	0.2	0	1
<b>Demographics: age by gender</b>				
All 16-24	23.7%			
Men 25-34	12.5%			
Women 25-34	11.0%			
Men 35-54	18.0%			
Women 35-54	19.5%			
All 55-64	12.0%			
All 65+	3.2%			
<b>Broad industry</b>				
Mining	0.1%			
Construction	12.6%			
Manufacturing	4.7%			
Wholesale trade	1.4%			
Retail trade	18.4%			
Transportation/communications/ utilities	4.8%			
Information	1.8%			
Financial activities	3.0%			
Professional/business services	9.6%			
Leisure and hospitality	19.9%			
Education and health services	13.6%			
Other services	8.9%			
Public administration	1.1%			
<b>Broad occupation</b>				
Management, business, financial	5.9%			
Professional and related	9.0%			
Services	32.7%			
Sales and related	13.3%			
Office and administrative support	12.5%			
Farming, fishing, forestry	0.1%			
Construction and extraction	10.6%			
Installation, maintenance, repair	2.7%			
Production	4.6%			
Transportation and material moving	8.5%			

Notes: Authors' calculations using Current Population Survey micro data & Burning Glass Technologies merged dataset, averaging over the period 2003Q1-2021Q2. Demographics, broad industry, and broad occupation are the share of involuntary part-time employed workers. The descriptive statistics of job vacancy were calculated at the market level, unemployment rate was calculated at the commuting zone level, and all other measurements were calculated at the individual level.

Figure 2. Binned Scatter of log Total Vacancies and Involuntary Part-time Employment Rate at the Market level (CZ X SOC-6)



Notes: This figure shows a binned scatter plot of the involuntary part-time employment rate by log of total vacancies in the Burning Glass Technologies dataset, and involuntary part-time employment in the corresponding commuting zone and occupation in 2003-2021.

## 4.2 Regression Results

Table 2 provides regressions of involuntary part-time employment on job vacancies. This table reports market-level regressions of involuntary-part time data on measured market job vacancy, for markets defined at the SOC-6 by commuting zone by quarter level. We begin our analysis with a simple regression allowing for variation across both time, occupational, and geographic dimensions (Table 2, Column 1). We find that a ten percent increase in job vacancies is associated with a 0.039 percentage point decrease in the share of involuntary part-time employment. As there are more jobs available in the external labor market, workers have more choice to have a job that they desire such as a full-time job in this case.

We further examine the relationship across year-quarters and within a market by adding market fixed effects (SOC-6 by CZ) (Table 2, Column 2). Controlling for geographic and occupation dimensions leads to a slightly smaller magnitude for the coefficient on log va-

cancies (-0.003), which implies that the negative association between involuntary part-time employment and job vacancies is partially driven by cross-sectional variation in involuntary part-time employment. Figure 3 shows a binned scatterplot corresponding to Column (2) of Table 2; the relationship between the residualized involuntary part-time employment and the residualized job vacancy is negative and linear, analogous to the raw relationship between involuntary part-time employment and job vacancy (Figure 2). When we further control for year-quarter fixed effects (Table 2, Column 3), the coefficient on log vacancies becomes larger (more negative, -0.008).

To control for the supply side of involuntary part-time employment, we add unemployment rate in our specification (Table 2, Column 4), together with market and year-quarter fixed effects. The results show that unemployment rate is positively associated with involuntary part-time employment. The coefficient on log vacancies is slightly smaller but remains consistent, which shows that the negative impact of job vacancies on involuntary part-time employment is not explained away by changes in the unemployment rate. On the supply side of the labor market, we further control for workers' demographic characteristics as it may affect the availability of part-time labor. Adding demographic characteristics (Table 2, Column 5) does not substantially change the result compared to the model without them (Table 2, Column 4). We consider Column 5 of Table 2 to be the main model. The results indicate that a ten percent increase in unemployment rate increases involuntary part-time rate by 0.19 percentage points, while a ten percent increase in job vacancies decreases involuntary part-time rate by 0.07 percentage points.

The number of vacancies has a robust and independent effect on involuntary part-time employment. If vacancies are correlated with unemployment, the coefficient on vacancies would decrease when controlling for unemployment. However, the results show that the coefficient on log vacancies remained unchanged. The fact that unemployment increases involuntary part-time employment has already been established in the prior literature. Therefore, columns 4 and 5 are the cornerstones of our contribution demonstrating that vacancies matter even after controlling for unemployment.

One might suggest that a reduction in job vacancies will lead to a higher unemployment rate, which would eventually increase involuntary part-time employment. Also, one might be interested in studying to what extent the interaction effect between job vacancy and unemployment rate affects involuntary part-time employment. For this purpose, we conducted mediation and interaction analyses (see Appendix B for further details). Findings from mediation analysis shows that the effect of job vacancy on involuntary part-time employment rate is partially mediated by the unemployment rate. The interaction effect shows a negative value meaning that higher job vacancies in the market will lead to smaller effect of the



unemployment rate on involuntary part-time employment. Thus, every additional vacancy will reduce the rate of involuntary part-time employment more in the markets that are more depressed.

In sum, all models show a negative and significant association between job vacancies and involuntary part-time employment. To put the magnitudes in context, the average share of involuntary part-time employment is 0.043 or 430 per 10,000 workers. On average, a ten percent increase in unemployment rate leads to 19 more involuntary part-time workers out of 10,000 employed workers. However, a ten percent increase in job vacancies leads to 7 fewer in voluntary part-time workers out of 10,000 employed workers. Therefore, involuntary part-time employment is countercyclical, but changes in job vacancies also contributes to explaining involuntary part-time employment. As predicted by search and matching models, both unemployment and job vacancies matter to determine equilibrium outcomes in labor markets.

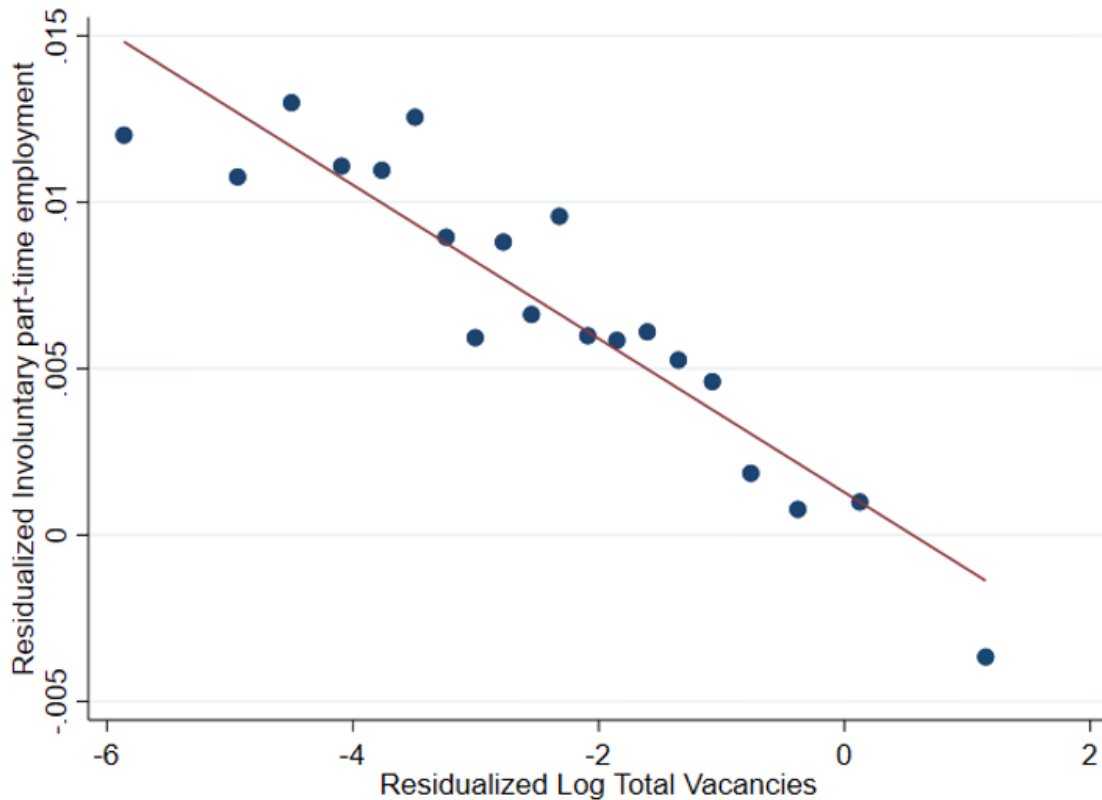
Table 2. Effect of Job Vacancy on Involuntary Part-time Employment: Market Level Regression Results, 2003-2021 (OLS method with market and YQ fixed effects)

	Involuntary part-time employment (fraction)				
	(1)	(2)	(3)	(4)	(5)
log(Total vacancies)	-0.0039*** (0.0001)	-0.0028*** (0.00034)	-0.0081*** (0.00098)	-0.0074*** (0.00101)	-0.0074*** (0.0001)
log(CZ unemployment)				0.0192*** (0.00391)	0.0193*** (0.00389)
Market(CZXSOC-6) FE		✓	✓	✓	✓
Year-Quarter FE			✓	✓	✓
Demographic controls					✓
R-squared	0.003	0.157	0.168	0.168	0.170
Within R-squared		0.001	0.014	0.014	0.016
Observations	419,578	419,578	419,578	419,578	419,578

Notes: Robust standard errors in parentheses. We cluster standard errors at the market level. All models employed vacancy weights. We used weights for the average number of vacancies in each labor market, therefore placing more emphasis on larger labor markets.

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

Figure 3. Binned Scatter of Residualized Log Job Vacancy and Residualized Involuntary Part-time Employment Rate with market fixed effects



Notes: This figure shows a binned scatter plot of the residuals of a regression of log job vacancies with market (CZ-by-SOC fixed effects), and the residuals of a regression of involuntary part-time employment in the same market (CZ-by-SOC) fixed effects.

### 4.3 Robustness Checks

We conducted several robustness checks. Table 3 shows our robustness check for the main model specification with market and year-quarter fixed effects and unemployment and demographic controls. First, we implemented our main specification without vacancy weights. We still find negative relationship between vacancy and involuntary part-time employment with a smaller magnitude. Second, we use employment weights instead of vacancy weights in the model. We find similar results with our main model with a smaller magnitude. Third, we examine the robustness of our results to alternative measures of CZ unemployment rate variable. We find similar results with state unemployment rate and a smaller effect with market unemployment rate. Fourth, we tested if the relationship between job vacancy and involuntary part-time employment holds even after controlling for labor market concentration. The OLS methods provided robust negative relationship, but the coefficient on job

vacancy turned positive for IV strategies. Lastly, we added unionization-related covariates to the model. We still find robust positive relationship between concentration and involuntary part-time employment.

#### **4.3.1 Without vacancy weights**

We used weights for the average number of vacancies in each labor market for the whole sample period, therefore placing more emphasis on larger labor markets. We tested whether the negative effect of job vacancy is driven by large or small labor markets. For this purpose, we ran the same specification as Column 5 in Table 2, but without vacancy weights. Eliminating vacancy weights reduces the coefficient from -0.007 to -0.003, implying that the impact of job vacancies on involuntary part-time employment is more negative in larger labor markets with more job vacancies (Table 3, Column 1).

#### **4.3.2 Alternative employment weights**

We chose the average number of job vacancies over the sample period in a given market as our baseline weights. This is because we had more information on vacancies than employment in a market defined as CZ by SOC-6. Using employment weights instead of vacancy weights makes the effect of job vacancies on involuntary part-time employment somewhat smaller but still highly significant (Table 3, Column 2).

#### **4.3.3 Alternative unemployment rate measures (state unemployment and market unemployment)**

We chose unemployment rate at the commuting zone level for the main analyses. In order to ensure that our findings are robust to alternative unemployment rate measures, first, we broaden the definition of unemployment to the state instead of the commuting zone (Table 3, Column 3). The results do not change when using the state unemployment rate. Also, even when we narrow the definition of a labor market from commuting zone to commuting zone by six-digit SOC level, the estimated effect of job vacancy on involuntary part-time employment remains the same (Table 3, Column 4).

#### **4.3.4 Controlling for labor market concentration (OLS and IV method)**

One potential measurement of labor demand side of involuntary part-time employment is employer concentration. One may be interested in how much employer power affects involuntary part-time employment. Economic theory predicts that labor market power decreases employment, which is confirmed by empirical evidence (Arnold, 2019; Marinescu and Hovenkamp,

2019). Since involuntary part-time employment is a measurement of labor underutilization, an increase in involuntary part-time employment implies a decrease in an hours-adjusted measure employment. Thus, to explore this question, we implemented a specification controlling for labor market concentration as a measure of employer power in addition to our main model with job vacancy, unemployment, and demographic characteristics.

Our findings show robust negative relationship between job vacancy and involuntary part-time employment, even after controlling for labor market concentration. The impact of labor market concentration on involuntary part-time employment is positive, but not significant (Table 3, Column 5). We provide additional results for the impact of employer market power on involuntary part-time employment in our appendix. Results showed that even after accounting for the number of job vacancies, lower employer concentration is associated with a lower prevalence of involuntary part-time work (see Appendix A for detailed results).

To address the endogeneity of labor market concentration, we use an instrumental variables strategy, following Azar et al. (2022). Our instrument for the IV specification is the inverse number of posting employers in other geographic markets for the same occupation in a given quarter. Accordingly, this instrument uses market concentration variation arising from changes in national-level occupational hiring patterns over time rather than from endogenous changes within a specific market. In the IV results, the effect of labor market concentration shows a significant positive coefficient with a larger magnitude than that of OLS. However, the coefficients for total vacancy and unemployment show the opposite direction. Thus, we do not have enough power to separately identify the effect of HHI, vacancies, and unemployment (Table 3, Column 6).

#### 4.3.5 Controlling for union-related covariates

In this section, we report on the regressions results as in Table 2 Column 5, including unionization-related covariates (Table 3, Column 7). We use occupation-level union membership and union coverage rates from the CPS. The results are similar to our main results, although the union coverage and membership are not significant. This indicates that the relationship between job vacancy and involuntary part-time employment is not affected by unionization-related characteristics.

We performed a number of additional robustness checks. Table 4 presents our additional checks with a focus on methodological considerations. We separated CZ and six-digit SOC fixed effects, employed individual level logit regression framework, and conducted fractional logit model. Our results show a robust negative relationship between involuntary part time employment and the number of job vacancies.

#### **4.3.6 Separating CZ and six-digit SOC fixed effects**

We included market fixed effects into our main specification which is defined as CZ by SOC-6 to test whether the negative relationship between job vacancy and involuntary part-time employment holds when we look at variation within geographic, occupation, and time dimensions separately. This specification slightly reduces the magnitude of job vacancy, but confirms the negative relationship (Table 4, Column 1).

#### **4.3.7 Individual level logit regressions**

We supplemented our market panel analysis using the CPS micro level data with a logit regression framework. This robustness check enables us to incorporate individual controls such as race, age, and marital status. Even at the individual level, we document a negative impact of job vacancy on involuntary part-time employment (Table 4, Column 2).

#### **4.3.8 Fractional Logit Model**

Fractional Logit Models provide an alternative to established linear and non-linear econometric solutions to the study of bounded dependent variables (Papke and Wooldridge, 1996, 2008). The negative association between log vacancies and involuntary part-time remains when using model, though the coefficient on log vacancies is somewhat smaller (Table 4, Column 3).

Table 3. Effect of Job Vacancy on Involuntary Part-time Employment: Robustness checks 1

	Involuntary part-time employment (fraction)						
	without Vacancy Weights (1)	Employment Weights (2)	with State UE (3)	with Market UE (4)	OLS with HHI (5)	IV with HHI (6)	with Union Covariates (7)
log(Total vacancies)	-0.0034*** (0.00057)	-0.005*** (0.00056)	-0.0075*** (0.00099)	-0.0079*** (0.00096)	-0.007*** (0.00109)	0.075* (0.0420)	-0.0073*** (0.00109)
log(CZ unemployment)	0.0249*** (0.00231)	0.0292*** (0.00244)			0.0191*** (0.00389)	-0.0272 (0.0283)	0.0253*** (0.00383)
log(state unemployment)			0.0223*** (0.00378)				
Market unemployment				0.0469*** (0.00644)			
log(HHI)					0.001 (0.00063)	0.222** (0.113)	
Union coverage							-0.0443 (0.0760)
Union membership							0.0515 (0.0838)
Market(CZXSOC-6) FE	✓	✓	✓	✓	✓	✓	✓
Year-Quarter FE	✓	✓	✓	✓	✓	✓	✓
Demographic controls	✓	✓	✓	✓	✓	✓	✓
R-squared	0.164	0.190	0.170	0.171	0.170	-1.302	0.177
Within R-squared	0.009	0.016	0.017	0.018	0.016		0.019
Kleibergen–Paap F-stat						3.770	
Observations	419,578	419,578	419,578	419,578	419,578	329,168	333,096

Notes: Robust standard errors in parentheses. We cluster standard errors at the market level. All models employed vacancy weights. We used weights for the average number of vacancies in each labor market, therefore placing more emphasis on larger labor markets.

(1) Without vacancy weights, (2) employment weights, (3) with state unemployment, (4) with market unemployment, (5) OLS with log HHI, (6) IV with log HHI, (7) with union-related covariates

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

Table 4. Effect of Job Vacancy on Involuntary Part-time Employment: Robustness checks 2

	Involuntary part-time employment (fraction)		
	Separate SOC-CZ (1)	Individual level (2)	Fractional Logit (3)
log(Total vacancies)	-0.005*** (0.00136)	-0.0448*** (0.00988)	-0.0039*** (0.0006)
log(CZ unemployment)	0.0203*** (0.0059)	0.657*** (0.0566)	0.0189*** (0.00395)
CZ FE	✓	✓	✓
SOC-6 FE	✓	✓	✓
Year-Quarter FE	✓	✓	✓
Demographic controls	✓	✓	✓
R-squared	0.122		
Within R-squared	0.0033		
Observations	419,578	1,745,820	419,578

Notes: Robust standard errors in parentheses. We cluster standard errors at the market level. All models employed vacancy weights. We used weights for the average number of vacancies in each labor market, therefore placing more emphasis on larger labor markets.

(1) Separate CZ-SOC fixed effects, (2) individual level regressions, (3) Fractional logit model

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

## 5 Discussion and Conclusion

A growing body of literature explores how low-wage labor market, characterized by limited workers' power and under-employment, can lower wages and inhibit workers' ability to have desired work hours (Azar et al., 2020; Borowczyk-Martins and Lalé, 2019; Faberman et al., 2020; Valletta et al., 2020). Our study builds on the literature by investigating the broader economic conditions leading to decreased job vacancies or increased unemployment rate, contributing to the prevalence of involuntary part-time work. Overall, we conclude that higher labor supply and lower labor demand both increase involuntary part-time employment. We also show that labor market power as measured by labor market concentration may additionally increase involuntary part-time employment. When labor demand weakens, it reduces the ability of the employed to find the work hours that they desire. Therefore, not only the unemployed, but also the employed represent a degree of labor underutilization that is relevant for policy decisions.

In this paper, we make three contributions. First, we calculated number of job vacancies

in local labor markets for the near universe of online vacancy posting from Burning Glass Technology. We have shown that job vacancies explain involuntary part-time employment in addition to other cyclical and structural factors. This relationship was robust. Thus, we show that employers' behavior is important to understand involuntary part-time employment. Second, we documented a positive relationship between labor market concentration and involuntary part-time employment which is consistent with the literature on monopsony power. This suggests that the imbalance between workers and employers contributes to the prevalence of involuntary part-time work. Finally, by merging BGT and CPS dataset, we investigate the underlying causes of high involuntary part-time employment rates on both workers' and employers' sides.

In conclusion, our study shows that employer behavior and practices are critical to capture labor market underutilization. Workers are more likely to have their preferred work hours when there are more employers that they can work for. Involuntary part-time employment is well accounted by the labor demand indicated by job vacancies, which exhibit notable deviations from the unemployment rate. Our study lays a foundation for further discussion around how macroeconomic policies can address the imbalance of power between workers and employers, can provide enough work hours that workers desire which are necessary to support low-wage workers and measure the health of the labor market. Our current paper aims to show the involuntary part-time rate in general, not specifically in major recessions. For our next study, we will explore how labor demand affects the involuntary part-time employment during and after a recession, including the COVID-19 crisis.



## References

- Abraham, K. G., J. C. Haltiwanger, and L. E. Rendell (2020). How tight is the us labor market? *Brookings Papers on Economic Activity* 2020(1), 97–165.
- Arnold, D. (2019). Mergers and acquisitions, local labor market concentration, and worker outcomes. *Local Labor Market Concentration, and Worker Outcomes (October 27, 2019)*.
- Azar, J., E. Huet-Vaughn, I. Marinescu, B. Taska, and T. Von Wachter (2019). Minimum wage employment effects and labor market concentration. Technical report, National Bureau of Economic Research.
- Azar, J., I. Marinescu, and M. Steinbaum (2022). Labor market concentration. *Journal of Human Resources* 57(S), S167–S199.
- Azar, J., I. Marinescu, M. Steinbaum, and B. Taska (2020). Concentration in us labor markets: Evidence from online vacancy data. *Labour Economics* 66, 101886.
- Blank, R. M. (1989). The role of part-time work in women’s labor market choices over time. *The American Economic Review* 79(2), 295–299.
- Blank, R. M. (1990). Understanding part-time work. *Research in Labor Economics* 11, 137–158.
- Borowczyk-Martins, D. and E. Lalé (2019). Employment adjustment and part-time work: Lessons from the united states and the united kingdom. *American Economic Journal: Macroeconomics* 11(1), 389–435.
- Borowczyk-Martins, D. and E. Lalé (2020). The ins and outs of involuntary part-time employment. *Labour Economics* 67, 101940.
- Bureau of Labor Statistics (2022a). Historical comparability of occupation and industry data from the current population survey.
- Bureau of Labor Statistics (2022b). Table a-12. unemployed persons by duration of unemployment.
- Cammeraat, E. and M. Squicciarini (2021). Burning glass technologies’ data use in policy-relevant analysis: An occupation-level assessment.
- Caputo, R. K. and M. Cianni (2001). Correlates of voluntary vs. involuntary part-time employment among us women. *Gender, Work & Organization* 8(3), 311–325.
- Dillender, M., C. J. Heinrich, and S. Houseman (2022). Effects of the affordable care act on part-time employment early evidence. *Journal of Human Resources* 57(4), 1394–1423.
- Euwals, R. and M. Hogerbrugge (2006). Explaining the growth of part-time employment: Factors of supply and demand. *Labour* 20(3), 533–557.

- Even, W. E. and D. A. Macpherson (2019). The affordable care act and the growth of involuntary part-time employment. *ILR Review* 72(4), 955–980.
- Faberman, R. J., A. I. Mueller, A. ŞAHIN\*, and G. Topa (2020). The shadow margins of labor market slack. *Journal of Money, Credit and Banking* 52(S2), 355–391.
- Faryna, O., T. Pham, O. Talavera, and A. Tsapin (2022). Wage and unemployment: Evidence from online job vacancy data. *Journal of Comparative Economics* 50(1), 52–70.
- Finnigan, R. (2018). Varying weekly work hours and earnings instability in the great recession. *Social science research* 74, 96–107.
- Flood, S., M. King, R. Rodgers, S. Ruggles, J. R. Warren, and M. Westberry (2022). Integrated public use microdata series, current population survey: Version 10.0 [dataset]. <https://doi.org/10.18128/D030.V10.0>.
- Ghoshsamaddar, S., A. Marchetti, and V. Sevchenko (2021). Who captures the value from organizational culture? evidence from glassdoor reviews and the universe of online job postings from burning glass technologies.
- Golden, L. and J. Kim (2020). The involuntary part-time work and underemployment problem in the us. *Center for Law and Social Policy*.
- Hershbein, B. and L. B. Kahn (2018). Do recessions accelerate routine-biased technological change? evidence from vacancy postings. *American Economic Review* 108(7), 1737–72.
- Holt, C. and M. David (1966). The concept of job vacancies in a dynamic theory of the labor market. In *The measurement and interpretation of job vacancies*, pp. 73–110. NBER.
- Lester, B. Y. (1996). Part-time employment of married women in the usa: A cross-sectional analysis. *American Journal of Economics and Sociology* 55(1), 61–72.
- Marinescu, I. and H. Hovenkamp (2019). Anticompetitive mergers in labor markets. *Ind. LJ* 94, 1031.
- Marinescu, I. and J. Rosenfeld (2022). Worker power and economic mobility: A landscape report.
- Miller, C. F. (1997). Structural change in the probability of part-time participation by married women. *Bulletin of Economic Research* 49(4), 257–273.
- Papke, L. E. and J. M. Wooldridge (1996). Econometric methods for fractional response variables with an application to 401 (k) plan participation rates. *Journal of applied econometrics* 11(6), 619–632.
- Papke, L. E. and J. M. Wooldridge (2008). Panel data methods for fractional response variables with an application to test pass rates. *Journal of econometrics* 145(1-2), 121–133.

- Pech, C., E. Klainot-Hess, and D. Norris (2021). Part-time by gender, not choice: The gender gap in involuntary part-time work. *Sociological Perspectives* 64(2), 280–300.
- Tilly, C. (1991). Reasons for the continuing growth of part-time employment. *MoNTHLY LAB. REv.* 114, 10.
- Valletta, R. G., L. Bengali, and C. Van der List (2020). Cyclical and market determinants of involuntary part-time employment. *Journal of Labor Economics* 38(1), 67–93.
- Yashiv, E. (2007). Labor search and matching in macroeconomics. *European Economic Review* 51(8), 1859–1895.

## A Additional Results on the Impact of Labor Market Concentration on Involuntary part-time Employment

Labor market competition is another factor that can influence involuntary part-time employment. In this section, we report on the regressions results as in Table 2, by focusing the impact of labor market concentration on involuntary part-time employment. The aim of this approach is to control for employer market power. Also, labor market concentration is likely negatively correlated with the number of vacancies: fewer vacancies would generally increase concentration, confounding the estimated job vacancies-involuntary part-time employment relationship. Thus, it is important to examine the impact of labor market concentration on involuntary part-time employment, controlling for number of job vacancies.

We define labor market Herfindahl Hirschman Index (HHI) at the SOC-6 occupation by commuting zone by quarter level as a weighted (by number of vacancies) average of occupation by commuting zone HHI; we use the logarithm of HHI as in prior literature. The formula for the HHI in market  $m$  and year-month  $t$  is:

$$HHI_{mt} = \sum_{j=1}^J S_{jmt}^2 \quad (3)$$

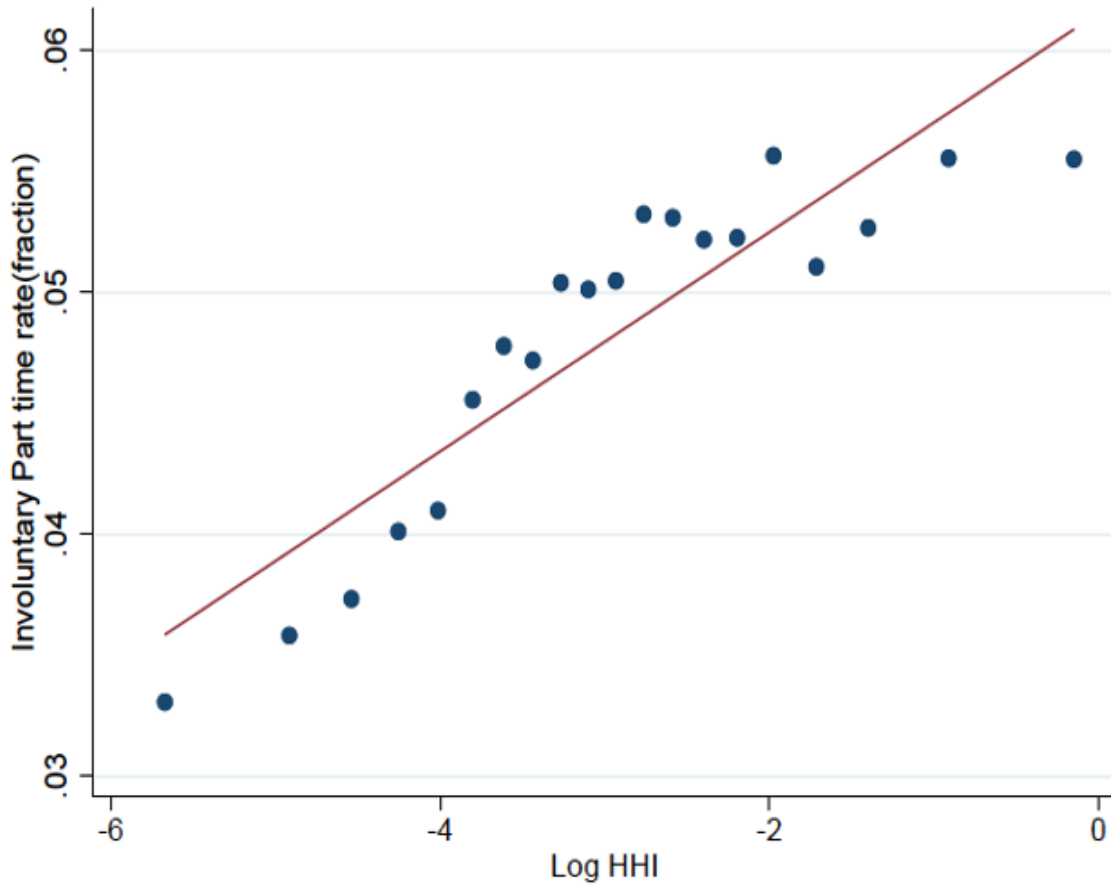
Where  $S_{jmt}$  is the market share of firm  $j$  in market  $m$ . For the HHI based on vacancies, the market share of a firm in a given market and year-quarter is defined as the sum of vacancies posted in Burning Glass Technologies (BGT) by a given firm in a given market and year-quarter divided by total vacancies posted on the website in that market and year-quarter. HHI focuses on the top 200 occupations.

To address the endogeneity of labor market concentration, we use an instrumental variables strategy, following [Azar et al. \(2020\)](#). Our instrument for the IV specification is the inverse number of posting employers in other geographic markets for the same occupation in a given quarter. Accordingly, this instrument uses market concentration variation arising from changes in national-level occupational hiring patterns over time rather than from endogenous changes within a specific market.

The raw relationship between log HHI and involuntary part-time employment shows a positive effect of HHI (Figure A1). Our OLS results in Table A1 documents that even after accounting for the number of job vacancies, higher employer concentration is associated with a higher prevalence of involuntary part-time work. The IV results are qualitatively similar with OLS as they mostly show the same direction of the coefficients, but quantitatively the instrumented estimates are much larger. With all controls, the impact of HHI goes in the expected direction but we don't have enough power to identify the effect of HHI as separate

separately and consistently from the effect of total vacancies (Table A1, panel B, Column 5).

Appendix Figure A1. Binned Scatter of log HHI and Involuntary Part-time Employment Rate at the Market level (CZ X SOC-6)



Notes: This figure shows a binned scatter of the involuntary part-time employment rate by log of Herfindahl-Hirschman Index for the top 200 SOC-6 occupations (ranked based on the number of vacancies) over the period 2003Q1–2021Q2 in the Burning Glass Technologies dataset, and involuntary part-time employment in the corresponding commuting zone and occupation in 2003-2021 (based on CPS data).

Appendix Table A1. Effect of Labor Market Concentration on Involuntary Part-time Employment: Market Level Regression Results, 2003-2021 (OLS method with market and YQ fixed effects)

	Involuntary part-time employment (fraction)				
	(1)	(2)	(3)	(4)	(5)
Panel A: OLS with log HHI					
log(HHI)	0.0075*** (0.00014)	0.0023*** (0.00042)	0.0025*** (0.00057)	0.001* (0.00063)	0.001 (0.00063)
log(CZ unemployment)				0.0189*** (0.00391)	0.0191*** (0.00389)
log(total vacancies)				-0.007*** (0.0011)	-0.007*** (0.00109)
Market(CZXSOC-6) FE		✓	✓	✓	✓
Year-Quarter FE			✓	✓	✓
Demographic controls					✓
R-squared	0.007	0.157	0.168	0.168	0.170
Within R-squared		0.000	0.013	0.014	0.016
Observations	419,578	419,578	419,578	419,578	419,578
	(1)	(2)	(3)	(4)	(5)
Panel B: IV with log HHI					
log(HHI)	0.0205*** (0.00041)	0.0071*** (0.00105)	0.0514*** (0.00689)	0.225** (0.113)	0.222** (0.113)
log(CZ unemployment)				-0.0279 (0.0285)	-0.0272 (0.0283)
log(total vacancies)				0.0757* (0.0423)	0.0747* (0.0420)
Market(CZXSOC-6) FE		✓	✓	✓	✓
Year-Quarter FE			✓	✓	✓
Demographic controls					✓
R-squared	-0.013	-0.000	-0.067	-1.336	-1.302
Kleibergen–Paap F-stat	61975	2921	123.6	3.822	3.770
Observations	331,039	329,168	329,168	329,168	329,168

Notes: Robust standard errors in parentheses. We cluster standard errors at the market level. All models employed vacancy weights. We used weights for the average number of vacancies in each labor market, therefore placing more emphasis on larger labor markets.

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

## B Additional Results on the Mediation and Interaction Analyses between Unemployment rate and Job Vacancy

### B.1 Single Mediation Effect

One might suggest that a reduction in job vacancies will lead to a higher unemployment rate, which would eventually increase involuntary part-time employment. Overall, the results of the mediation analysis suggest that unemployment rate partially mediates the relationship between the number of job vacancies and involuntary part-time employment. Sobel's test is significant, and the mediation is partial. Approximately, 37 percent of the effect of total vacancies on involuntary part-time employment rate is mediated by log commuting zone unemployment rate.

Appendix Figure B1. Log commuting zone unemployment rate as a mediator of the relationship between log total job vacancies and involuntary part-time employment rate



Notes: with no market fixed effects or yq fixed effects or vacancy weights.

Appendix Table B1. Beta coefficients for path analysis

path	path (descriptive)	beta coefficient
c	Total effect of log job vacancies on involuntary part-time employment	-0.003
c'	Direct effect of effect of log job vacancies on involuntary part-time employment controlling for log CZ unemployment rate and demographic characteristics	-0.002
a	Effect of log job vacancies on log CZ unemployment rate, controlling for demographic characteristics	-0.032
b	Effect of log CZ unemployment rate on involuntary part-time employment, controlling for log job vacancies and demographic characteristics	0.033

## B.2 Interaction Effect

Table B2 provides the effects of interaction between CZ unemployment rate and job vacancies on involuntary part-time employment. The interaction effect shows a negative value meaning that higher job vacancies in the market will lead to smaller effect of the unemployment rate on involuntary part-time employment. Thus, every additional vacancy will reduce the rate of involuntary part-time employment in the markets that are more depressed. This result implies that workers are more likely to get a job that they want even though they are unemployed or that market is depressed, if they have more options available in the market.

Appendix Table B2. The Interaction Effect between Unemployment and Job vacancy on Involuntary Part-time Employment, 2003-2021 (OLS method with Market and Year fixed effects)

	Involuntary part-time employment (fraction)	
	(1)	(2)
log(Total vacancies)	-0.0176*** (0.00227)	-0.0177*** (0.00225)
log(CZ unemployment rate)	0.043*** (0.00265)	0.0435*** (0.00263)
Vac X Unemp	-0.0037*** (0.00086)	-0.0037*** (0.00086)
Market(CZXSOC-6) FE	✓	✓
Year-Quarter FE	✓	✓
R-squared	0.169	0.171
Within R-squared	0.015	0.017
Observations	419,578	419,578

Notes: Robust standard errors in parentheses. We cluster standard errors at the market level. All models employed vacancy weights. We used weights for the average number of vacancies in each labor market, therefore placing more emphasis on larger labor markets.

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$



## C Sensitivity test for different unemployment rate definitions

In this section, we examine whether different measurement of unemployment rate would affect the relationship between job vacancies and involuntary part-time employment. First, with our full analytic sample, we compare the log commuting zone unemployment rate, log state unemployment rate and market unemployment rate. The results show that the coefficients on job vacancies remain the same (Table C1, Columns 1-3). The market level unemployment rate includes zeros in many markets. Thus, if we use the logarithm of market unemployment rate, it will lead us to a smaller sample size (N=50,533). To compare the effect of log market unemployment rate with other unemployment rate definitions, we restrict the sample with observations that do not have zero market unemployment rates. Even with the restricted sample, the effect of job vacancies remains the same regardless of the different measurements of unemployment rate (Table C1, Columns 4-7).

Appendix Table C1. Effect of Job Vacancy and Different Levels of Unemployment on Involuntary Part-time Employment: Market Level Regression Results, 2003-2021 (OLS with market and YQ fixed effects)

	Involuntary part-time employment (fraction)						
	with whole analytic sample			with restricted sample			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
log(Total vacancies)	-0.00740*** (0.001)	-0.00746*** (0.001)	-0.00788*** (0.00096)	-0.0114*** (0.00183)	-0.0114*** (0.00182)	-0.0106*** (0.00198)	-0.0105*** (0.00195)
log(CZ unemployment)	0.0193*** (0.00389)			0.0229*** (0.00987)			
log(state unemployment)		0.0223*** (0.00378)			0.0319*** (0.0102)		
Log (Market unemployment)						0.00580*** (0.00121)	
Market unemployment			0.0469*** (0.00644)				0.0557*** (0.0125)
Market(CZXSOC-6) FE	✓	✓	✓	✓	✓	✓	✓
Year-Quarter FE	✓	✓	✓	✓	✓	✓	✓
Demographic controls	✓	✓	✓	✓	✓	✓	✓
R-squared	0.17	0.17	0.171	0.301	0.302	0.3	0.3
Within R-squared		0.017	0.018	0.035	0.037	0.034	0.035
Observations	419,578	419,578	419,578	54,022	50,533	50,533	50,533

Notes: Columns 1-3 shows the relationship with the whole analytic sample and columns 4-7 shows the relationship within the restricted sample. Robust standard errors in parentheses. We cluster standard errors at the market level. All models employed vacancy weights. We used weights for the average number of vacancies in each labor market, therefore placing more emphasis on larger labor markets.

(1) With CZ unemployment rate, (2) With state unemployment rate, (3) With market unemployment rate, (4) With CZ unemployment rate, (5) With state unemployment rate, (6) With log market unemployment rate, (7) With market unemployment rate

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

## D Additional Results on the Impact of Full-time Job Vacancies on Involuntary Part-time Employment

Involuntary part-time employment occurs when part-time workers cannot find a full-time job. To directly examine this phenomenon, we calculate the total full-time job vacancies and examine its impact on involuntary part-time employment. The results show that a ten percent increase of full-time job vacancies reduce involuntary part-time work by 0.06 percentage points (Table D1, Column 5). Thus, we provide suggestive evidence that full-time job creation may help workers have their desired work hours.

Appendix Table D1. Impact of Full-time Job Vacancies on Involuntary Part-time Employment

	Involuntary part-time employment (fraction)				
	(1)	(2)	(3)	(4)	(5)
log(full-time job vacancies)	-0.0053*** (0.0001)	-0.0036*** (0.00038)	-0.0068*** (0.00084)	-0.0064*** (0.00087)	-0.0064*** (0.00085)
log(CZ unemployment)				0.0199*** (0.00391)	0.0201*** (0.00389)
Market(CZXSOC-6) FE		✓	✓	✓	✓
Year-Quarter FE			✓	✓	✓
Demographic controls					✓
R-squared	0.007	0.158	0.169	0.169	0.171
Within R-squared		0.001	0.014	0.014	0.016
Observations	396,713	396,713	396,713	396,713	396,713

Notes: Robust standard errors in parentheses. We cluster standard errors at the market level. All models employed vacancy weights. We used weights for the average number of vacancies in each labor market, therefore placing more emphasis on larger labor markets.

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$