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# Cyclical and Market Determinants of Involuntary Part-Time Employment

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# Cyclical and Market Determinants of Involuntary Part-Time Employment


## Abstract

We examine the determinants of involuntary part-time employment, focusing on variation associated with the business cycle and variation attributable to more persistent structural features of the labor market. Our theoretical framework distinguishes between workers' decision to seek part-time work and employer demand for part-time work hours, emphasizing demand and supply determinants of involuntary part-time work such as workplace technology, labor costs, and workforce demographics. We conduct regression analyses using state-level panel and individual data for the years 2003-2014. The results show that the combination of cyclical variation and the influence of market-level factors can explain virtually all of the variation in the aggregate incidence of involuntary part-time employment since the Great Recession.

# Cyclical and Market Determinants of Involuntary Part-Time Employment

## I. Introduction

Part-time employment is common in the United States. Since the mid-1990s, on average slightly more than one in six U.S. civilian employees worked part-time hours, defined as fewer than 35 hours per week. In their tracking of part-time employment, the U.S. Bureau of Labor Statistics (BLS) distinguishes between individuals who work part-time voluntarily ("non-economic reasons") and those who work part-time involuntarily ("economic reasons"). Interest in the involuntary part-time group has increased in recent years as its share of the workforce reached unusually high levels during the Great Recession of 2007-2009. Moreover, as the U.S. economy recovered from that recession, the level of involuntary part-time work remained relatively high, raising questions about whether this group of workers reflects labor market underutilization or slack beyond that reflected in the unemployment rate (Yellen 2014; Valletta and van der List 2015).

In this paper, we examine the determinants of involuntary part-time work, distinguishing between variation associated with the business cycle and variation attributable to more persistent features of the labor market. Despite the growing interest in involuntary part-time workers, recent research on their characteristics and behavior is quite limited in quantity and scope, with a small set of recent studies examining general patterns in involuntary part-time work and the impact of the Affordable Care Act's requirement that large employers provide health insurance to full-time workers (e.g., Cajner, Mawhirter, Nekarda, and Ratner 2014; Canon, Kudlyak, Luo, and Reed 2014; Robertson and Terry 2014; Even and Macpherson 2015). An earlier set of papers focused on identifying the behavioral distinction between voluntary and involuntary part-time work and provided information on a limited set of explanatory factors (Stratton 1996; Leppel and Clain 1988, 1993; Fallick 1999; Tilly 1991). We expand on existing research by developing a general framework for understanding changes in the incidence of involuntary part-time work and providing a broad assessment of explanatory factors for the years 2003-2014. The cyclical and

structural market factors that we identify can largely account for changes in involuntary part-time work observed during the Great Recession of 2007-2009 and its aftermath.

We begin in Section II by discussing our Current Population Survey (CPS) individual data on part-time employment by type and providing descriptive statistics to illustrate their basic patterns over time and across labor market groups. These descriptive analyses provide the basis for our theoretical framework described in Section III, which highlights the importance of market-level (demand and supply) determinants of involuntary part-time work such as workplace technologies (which differ across industries), labor costs, and workforce demographics. The regression analyses reported in Section IV, conducted separately on state-level panel data and the CPS microdata, confirm the importance of cyclical and market-based factors. In Section V, we use the state panel regression results to provide a detailed decomposition of the contributions of the cyclical and structural market factors to the evolution of the aggregate rate of involuntary part-time employment over our sample period.

To preview, our results show that the cyclical component accounts for most of the variation over time in the incidence of involuntary part-time work. However, additional elevation in the rate of involuntary part-time work through 2014 is largely attributable to other more persistent features of the labor market, mainly changes in the industry composition of aggregate employment. We interpret these findings and note implications for future research in the concluding section.

## II. Patterns in Voluntary and Involuntary Part-Time Work

### *A. CPS Data and Definitions*

Our empirical analyses rely primarily on data from the monthly CPS microdata files for the period 2003-2014.[1] The CPS is the monthly household survey conducted by the U.S. Census Bureau for the BLS, and is used for calculating official U.S. labor force statistics such as labor force status,

[1] http://thedataweb.rm.census.gov/ftp/cps_ftp.html

unemployment, and work hours. The CPS surveys about 60,000 households each month, yielding information on hours worked and related variables for monthly samples of about 70,000 employed individuals. We limit our empirical analyses to individuals age 16 and over who are employed in nonagricultural wage and salary jobs and at work during the reference week. Following most work that focuses on hours and wages using CPS data, we exclude observations with imputed (allocated) values of hours worked (see e.g. Buchmueller, DiNardo, and Valletta 2011).

Our primary analysis period of 2003-2014 largely covers the business cycle associated with the Great Recession plus additional recovery years during which the level of involuntary part-time work was unusually elevated relative to historical patterns (Valletta and van der List 2015). As such, it is an appropriate timeframe for analyzing cyclical and structural determinants of involuntary part-time work. In addition, restriction to 2003-forward eliminates the distorting influence of major changes in industry category definitions applied to the CPS microdata in the early 2000s.[2]

The CPS survey distinguishes between two broad groups of persons who work part-time. The first is those working part-time for "noneconomic" reasons, or voluntarily. These are workers whose part-time status represents a labor supply decision (hence "noneconomic reasons" is a slight misnomer): they prefer a part-time job for personal reasons such as family obligations, school, or partial retirement.[3] Of the nearly 20 percent of employed people who work part time, about three-fourths are in this category. The other category is those working part time for "economic" reasons, or involuntarily. This includes workers who report that they would like a full-time job but cannot find one due to constraints on the employer side of the labor market, such as a cutback in hours at their current job ("slack work") or an inability to find

[2] The industry re-definitions associated with the switch to the 2000 NAICS codes substantially altered the definitions and measured employment shares for key industries for our analysis, notably retail and personal services. In addition, our state level analyses rely on estimates of IPT employment calculated from published BLS figures on alternative measures of labor underutilization at the state level, which only became available beginning in 2003.

[3] As indicated in the monthly BLS employment reports, noneconomic reasons include "childcare problems, family or personal obligations, school or training, retirement or Social Security limits on earnings, and other reasons."

full-time work.[4] As such, involuntary part-time work primarily reflects labor demand considerations. More precisely, as we discuss further in Section III, involuntary part-time work reflects excess demand by employers for individuals willing to work part-time hours relative to the supply of such individuals.

Past research has found the distinction between voluntary and involuntary part-time work to be meaningful, based on the greater tendency for involuntary part-time workers to be working full-time in the future than voluntary part-time workers (Stratton 1996). With this distinction in mind, we compare and contrast the behavior and composition of the two groups of part-time workers in the next section. In the remainder of the paper, we will refer to involuntary part-time work as IPT and voluntary part-time work as VPT.

***B. Comparisons Over Time and Across Groups***

Because patterns in IPT and VPT work over time and across groups are not well known, we begin with descriptive analyses, using published data for the period 1994 forward combined with calculations from the CPS microdata.[5] The level of VPT work may affect the number of IPT workers through the interaction of market-level supply and demand (discussed further in Section III). We therefore provide descriptive statistics for both components, plus their sum.[6]

Figure 1 displays the time pattern for IPT and VPT work along with their sum, all expressed as a share of total civilian employment. The incidence of VPT employment has been trending downward slightly over the past few decades and was largely unchanged during the Great Recession and its aftermath (Valletta and Bengali 2013 provide longer time-series). By contrast, the incidence of IPT

[4] More precisely, economic reasons include "slack work or unfavorable business conditions, inability to find full-time work, or seasonal declines in demand."

[5] There is a break in the involuntary and voluntary part-time work series in 1994 due to a change in CPS survey procedures and definitions that tightened the IPT criteria. The revised survey required those identified as IPT to state explicitly that they want and are available for full-time work, rather than inferring this from their responses to related questions. This break produced a significant shift in overall part-time employment and also the relative levels of the IPT and VPT series (Polivka and Miller 1998; Valletta and Bengali 2013).

[6] The sum of the two series differs slightly from the BLS measure of overall part-time work because the overall series is based on usual weekly work hours while the VPT and IPT components are based on hours worked during the survey reference week.

employment rose substantially during the Great Recession and has come down only slowly since then. This counter-cyclical pattern also was evident but less pronounced around the 2001 recession. The strong counter-cyclicality in IPT employment combined with the non-cyclical VPT series generates counter-cyclicality in overall part-time work.

Figure 2 provides additional information on cyclical patterns in IPT by displaying the overall series (Panel A) and its sub-components (Panel B) against the unemployment rate. Panel A shows that the IPT rate typically tracks the unemployment rate entering recessions, suggesting that the two are closely related measures of labor market slack. However, the decline in the IPT rate has lagged declines in the unemployment rate, with the lag especially evident in the aftermath of the Great Recession. Panel B displays the two sub-components of the IPT series. The "slack work" component refers to individuals whose work hours were reduced due to weak demand, with the remaining component representing individuals who report that they are unable to find full-time jobs. The slack work component generally tracks the unemployment rate and had returned nearly to its pre-recession level as of late 2015. The component representing an inability to find full-time work also is counter-cyclical but has shown only a limited decline during the recovery from the Great Recession, largely accounting for the pattern in the overall IPT rate noted in Panel A. Comparison of the two components suggests that hours cutbacks associated with the Great Recession had largely dissipated by late 2015, but the overall incidence of part-time employment remained somewhat elevated. This pattern suggests that employers created or maintained an unusual number of part-time jobs during the recovery from the recession.

It is also instructive to examine variation in VPT and IPT rates across labor market groups and sectors. Table 1 lists figures for 2003 and 2014, which span the primary analysis period in subsequent sections and also represent years with similar labor market conditions.[7] The calculations for the complete sample yield VPT and IPT fractions that are close to official BLS data releases, with small variation

[7] The U.S. unemployment rate averaged 6.0 percent in 2003 and 6.2 percent in 2014 (although employment growth was much more rapid in the later year)

attributable to our sample restrictions. The figures listed in Table 1 refer to the group-specific employment share by part-time status. For example, the number in the second row, first column of the table indicates that 35.2 percent of employed individuals age 16-24 were voluntary part-time workers in 2003, while the third column indicates that 6.1 percent of that group were involuntary part-time workers in 2003; the remaining 58.7 percent are employed full-time (with the exception of the small group of part-time workers referred to in footnote 6 above). For reference purposes, the final two columns provide the share of each group in overall employment; for example, the number in the second row, column (8), indicates that 13.3 percent of all employed individuals (part-time and full-time) in 2014 were aged between 16 and 24.

The figures in the table show a relatively consistent pattern over time across the various age/gender, education, and racial/ethnic groups. VPT work was largely stable or fell slightly for most groups (columns 1 and 2), while IPT rose for all groups (columns 3 and 4), causing the sum of VPT and IPT to be slightly higher in 2014 than in 2003 (columns 5 and 6). Employment in both categories of part-time work is generally higher for lower skill workers, especially the young. The employment shares in the final two columns show declines over our sample period for some age/gender groups with high rate of part-time work (e.g., 16-24 year olds) and increases for others (e.g., age 65 and over).[8]

The bottom portion of Table 1 shows substantial variation across industries in the incidence of part-time work (see Robertson and Terry 2014 for related comparisons). Both VPT and IPT work are especially high in selected services industries, such as retail and especially leisure and hospitality (including restaurants) and other services (mostly personal services, such as barber and beauty shops, dry cleaning, repair services, etc.). By contrast, part-time work of both types tends to be low in manufacturing and related industries such as wholesale trade and transportation. A slow shift in employment over time away from manufacturing and toward the services industries that rely more heavily on part-time labor is

[8] We group men and women together in the youngest and oldest age categories, because their rates of IPT are relatively similar within these age groups and the aggregated categories improve the statistical precision of the regression analyses conducted in Section IV.

evident in the employment share comparisons for 2003 and 2014 displayed in the final two columns of the table. This shift toward service industries may put upward pressure on the overall proportion of part-time jobs in the work force.

On balance, the descriptive figures and table illustrate substantial differences over the business cycle and time, and also across labor market groups, in the incidence of voluntary and involuntary part-time work. We provide a framework for understanding these changes and their determinants in the next section.

## III. Insights from Economic Theory

### *A. Determinants of Part-Time Work*

The empirical patterns illustrated and discussed in the preceding section shed light on the determinants of part-time work from the perspective of economic theory.

Figures 1 and 2 in the previous section illustrated sharp counter-cyclical variation in the IPT rate, with an especially pronounced rise during the Great Recession followed by slow decline. One likely reason for this pattern is labor hoarding: to minimize turnover costs, hours adjustments may be preferred to changes in head counts. This cost factor may be reinforced by experience rating in the U.S. unemployment insurance (UI) system. By reducing hours rather than laying off workers, firms avoid the additional UI taxes that are incurred proportional to their layoff history. Moreover, even during a recovery period, if demand uncertainty or volatility is high, greater reliance on part-time employees may be a cost-effective means for enhancing employment flexibility (Euwals and Hogerbrugge 2006; Borowczyk-Martins and Lalé 2014, 2015).[9]

[9] Available evidence suggests that employer uncertainty was high during the Great Recession and recovery (Baker, Bloom, and Davis 2015).

There are also a number of secular or slow-moving market factors, such as industry structure, labor costs, and workforce demographics, which could affect the relative demand and supply for part-time work and consequently the level of involuntary part-time work.[10]

As established in the preceding section (Table 1), VPT and IPT rates vary substantially across industries. One reason for such differences is a "peak-load" pattern in which demand is predictably high at certain limited times during the day (e.g., a lunch or dinner rush at a restaurant). Although full-time workers can be repurposed between peak periods to some degree, relying on part-time workers (e.g., 4-5 hour shifts) is one cost-effective approach to meeting peak-load demands. Peak-load demand patterns are widespread in the retail and hospitality sectors. If the employment share of industries with such peak-load challenges rises, employer demand for part-time labor will rise as well (see Euwals and Hogerbrugge 2006).

Another potential source of changes in demand for part-time labor is labor costs. If the per-hour costs of employees increase, employers may reduce work hours by shifting from full-time to part-time labor and also substituting capital for labor.[11] Given that many part-time jobs are low-skilled jobs concentrated in the retail and services sectors, the level of the minimum wage may be an important element of labor costs. Employers' cost of employee health benefits is another element of labor costs that may be relevant for the use of part-time labor, particularly given that part-time employees can be excluded from employer health benefit plans according to applicable tax rules (Carrington, McCue, and Pierce 2002).

The incidence of IPT work may also have been affected in recent years by the 2010 passage of the Affordable Care Act (ACA). The law includes a mandate that employers with at least 50 full-time

[10] Abhayaratna, Andrews, Nuch, and Podbury (2008) provide a detailed discussion of many of these considerations in the Australian context.

[11] Part-time wage rates are typically less than full-time wage rates, which lowers employers' costs of hiring part-time workers. Much of the wage gaps appears to be explained by the observable characteristics of part-time versus full-time workers and jobs, although existing research suggests that a substantial gap remains after accounting for these differences (Baffoe-Bonnie 2004; Hirsch 2005; Canon et al. 2014).

employees must provide health benefits to employees who work at least 30 hours per week or pay a penalty. The mandate was originally scheduled for implementation in 2014 but was delayed to 2015-16. Employer adjustments to the mandate may have occurred prior to its implementation. Analysis to date has produced conflicting results about ACA effects on part-time work, although the recent findings of Even and Macpherson (2015) are persuasive with respect to a mandate-induced increase in IPT work since 2010.[12] We discuss these findings in light of our own in more detail in the Conclusion section.

In addition to these potential sources of changing demand for part-time labor, general changes in the technology of production may have enhanced employers' ability to utilize part-time work. Advances in monitoring technology have given firms accurate and detailed information about demand patterns. New scheduling technologies enable employers to schedule part-time work more efficiently and at lower cost. Both of these developments should facilitate the use and allocation of part-time labor.[13]

On the supply-side of the labor market, the evolving demographic composition of the labor force may affect the availability of part-time labor (see the Table 1 discussion in the previous section). Young workers are a key source of voluntary part-time employment, but their share in the workforce and population has been declining. This may cause employers seeking part-time employees to rely more heavily on demographic groups who prefer full-time work, thereby increasing the incidence of IPT. A similar story applies to women age 35-54. By contrast, workers age 65 and over have a very high incidence of part-time work, but their share of the workforce has been growing. The net impact of such demographic changes is ambiguous.

[12] Based on a cross-industry difference-in-difference analysis that exploits differential exposure to the ACA mandate, Even and Macpherson (2015) conclude that employer anticipation of the mandate explains a substantial proportion of the elevated rate of IPT employment. Other studies that they cite do not find such a link. Even and Macpherson attribute this divergence to methodological differences. The findings of Buchmueller, DiNardo, and Valletta (2011) regarding the impact of a similar mandate in Hawaii suggest that higher incidence of part-time work is likely after the mandate takes effects, if not before.

[13] Greenhouse (2012) provides anecdotal evidence for the United States.

### *B. Theoretical considerations for demand and supply factors*

The considerations discussed in the preceding sub-section are readily embedded into standard economic theory regarding employer production activity and consumer/worker behavior. Although conventional labor supply models assume that work hours can vary continuously, realistic alternatives recognize demand-side constraints on work hours that restrict individuals to the choice of no work, full-time work, or part-time work (e.g., Chang, Kim, Kwon, and Rogerson 2011).[14] We follow the approach established in such partially indivisible labor models and present a stripped-down framework to highlight the relevant characteristics of the demand and supply sides of the labor market.

We assume that employers combine full-time and part-time labor with capital to produce output and maximize profits. The two types of labor are assumed to be imperfect substitutes, due for example to systematic differences in their characteristics (including skill sets and tasks) and employers' need to coordinate work hours (Montgomery 1988). The firm's profit maximization objective is:

$$\max \pi = \mathrm{p} * f\left(L_f, L_p,\ K\right) - w_f L_f - (\rho w_f) L_p - rK \qquad (1)$$

where $L_f$ is hours of full-time labor, $L_p$ is hours of part-time labor, and $K$ is capital. Output is determined by the production function $f(.)$ and is sold at the price $p$. The rental rate of capital is $r$. We assume that the wage rate paid to part-time workers is proportional to the full-time wage ($w_f$), based on the factor $\rho$. This assumption is intended to capture the typical wage gap between part-time and full-time workers (see footnote 11) and also the possibility that changes in technology may reduce the relative costs of using part-time labor (e.g., reduced costs for scheduling and coordinating part-time work). The standard results (first-order conditions) from this framework imply that firms maximize profits by setting the marginal products of factor inputs equal to their wage or rental rate.

[14] In related recent work, Pencavel (2015) highlights the role of the demand side of the labor market in the determination of weekly hours.

On the supply side of the labor market, consumers choose work hours to maximize utility subject to a budget constraint:

$$\max U = u(l, c)\ subject\ to\ rK + wh = c, or \qquad (2)$$
$$\max U = u(1 - h, rK + wh)$$

where $l = 1 - h$ is non-work time, $h$ is hours of work, $c$ is consumption, $r$ is the rental rate of capital, and $w$ is the wage. Consistent with the partially indivisible labor assumption in production, consumers choose between full-time work hours, part-time work hours, or no work. We assume heterogeneous groups of consumers with different marginal utilities of non-work time and consumption (so that not all consumers make the same employment and labor force choices). The marginal utility of non-work time may reflect in part the value of human capital investment such as formal schooling that increases future earnings and consumption.

Under these circumstances, consumers will compare the utility or value function from the different work options and choose the option that yields the highest level of utility. That is, consumers solve:

$$max\{u(work\ full\ time), u(work\ part - time), u(no\ work)\} = \qquad (3)$$
$$max\{u(1 - h_f, rK + w_f h_f), u(1 - h_p, rK + \rho w_f h_p), u(l, rK)\},$$

where $h_f$ and $h_p$ are the specified hours of full and part-time work, and all other variables are as defined in the discussion of firms. In general, a given consumer will prefer full-time work when his or her marginal utility of non-work time is low, will prefer no work when the marginal utility of non-work time is very high, and will prefer part-time work when the marginal utility of non-work time is at an intermediate level.

This demand and supply framework can be used to describe how involuntary part-time work may respond to changes in demand and supply factors including industry composition, technology, labor costs, and workforce demographics.

Consider an increase in the relative marginal productivity of part-time work or decline in the relative cost ($\rho$) of employing part-time labor. Such changes could occur due a shift in aggregate production activity toward industries with greater needs for part-time labor (e.g., industries with peak-load demand patterns), or an improvement in scheduling technologies that reduces coordination costs for part-time work schedules. Under these circumstances, employers' demand for part-time labor relative to full-time labor will rise. Alternatively, an increase in wages relative to the rental costs of capital will tend to reduce reliance on labor hours. This is likely to increase employer demand for part-time labor as well, particularly in the presence of turnover costs that make it costly to change head counts rather than reducing hours worked. These factors also will tend to contribute to the counter-cyclical patterns in reliance on part-time labor noted in the previous section.

On the supply side of the labor market, changes in the demographic composition of the population or labor force will alter the tradeoff between desired work schedules and consumption in the aggregate utility function. For example, young workers place a high value on non-work time spent in formal schooling, contributing to their high rates of part-time work. A decline in the population share of young workers will therefore tend to reduce the fraction of workers who prefer part-time work at prevailing wage rates.

If factors such as those noted above increase aggregate demand for part-time labor while the supply of workers who prefer part-time work is constant or declining, the result will be an increase in the incidence of involuntary part-time work. An increase in the relative wage of part-time to full-time work may occur as well and act to offset the increase in IPT work. However, with inelastic labor supply to part-time and full-time work, or more general downward wage rigidity, wages will adjust slowly to the

changing market conditions.[15] Moreover, workers choosing between part-time and full-time employment tend to be low skill, hence the minimum wage may be a binding constraint on the decline in the relative wage paid for full-time work.

This discussion illustrates the importance of potential demand and supply influences on the incidence of involuntary part-time work. Because aggregate time-series data are not adequate to separately identify the various determinants of IPT employment described in this section, the remainder of the paper discusses an empirical framework based on state panel data and individual data.

## IV. Regression Framework and Results

We use two data sources and regression frameworks to assess the contributions of the factors discussed in the preceding section to changes in involuntary part-time work for the period 2003-2014: (1) state panel data, relying primarily on fixed-effects specifications; (2) CPS microdata with detailed individual and state effects.

### *A. State Panel Regressions*

Our state panel dataset consists of annual observations on involuntary part-time employment rates and possible explanatory factors covering the period 2003-2014.[16] We focus on explaining the IPT share of total civilian employment in each state and year, referred to as the IPT rate.

To motivate the regression analyses, Figure 3 displays the cross-section correlation (2013 only) between the unemployment rate and the IPT rate for the 50 states and the District of Columbia in 2013 (expressed as percentages). Each observation is weighted by the state's employment count, indicated by the relative size of the circles. Consistent with the counter-cyclicality illustrated in Figures 1 and 2 (Section II), or tendency for the IPT rate to track the unemployment rate over time, the fitted correlation line shows a positive relationship between the unemployment and IPT rates. This relationship is not

[15] See Daly and Hobijn (2014) for empirical evidence on downward nominal wage rigidity.
[16] See Appendix A for additional details on state data sources and definitions.

perfect, however; some states have higher or lower rates of involuntary part-time work relative to the general pattern. For example, focusing on two states with large labor forces, California and Michigan had similar unemployment rates in 2013, but the prevalence of involuntary part-time employment was about 2 percentage points higher in California (the two states are labeled in the chart).

It is likely that at least some portion of the variation in IPT employment not associated with the unemployment rate is explained by the additional market demand and supply factors discussed in the preceding section. In order to assess the contributions of these factors to the IPT rate, we run regressions based on the following model for our state panel data:

$$IPT_{st} = \alpha + f(U_{st})\beta + X_{st}\gamma + \varphi_s + \delta_t + \epsilon_{st} \quad (4)$$

where *s* and *t* index state and time (year). Because the dependent variable, the IPT rate, is measured as a fraction and takes values close to zero but bounded above it, we used the conventional log-odds transformation to express the dependent variable as *ln(IPT/(1-IPT))*.[17] The parameters β and γ represent vectors of coefficients to be estimated, to capture the effects of the variable sets $f(U_{st})$ and $X_{st}$ described below.

We specify the cyclical component of variation in IPT as a flexible function of the state unemployment rate, $f(U_{st})$. We use a quadratic function because we found it explains more variance than a purely linear function, while higher order polynomial terms did not further improve the fit. Our broad results are relatively insensitive to this choice.

The vector *X* includes the variables that capture state labor market conditions that are relevant for the determination of IPT employment, as described in Section III. The categories and specific variables used are as follows.

[17] Estimation based on a linear model generates a poor fit, especially for the cyclical component of the IPT rate (results available on request).

(1) State labor costs. We include two variables to capture relevant features of the state wage distribution: the real median wage and the legislated state minimum wage (measured as a proportion of the state nominal median wage).[18]

(2) Industry employment shares. We include a complete set of broad industry categories, with government employment treated as the excluded category.[19]

(3) Population shares by age group and gender (combined in some cases; age 16 and over).

The regression models also include a complete set of state effects ($\varphi_s$). We focus on fixed-effects specifications but also include random effects estimates for comparison. The state fixed effects are included to account for the influence of unmeasured time-invariant characteristics of state labor markets that may distort the estimated relationship between the IPT rate and the explanatory factors. In these regressions, the coefficients on the explanatory variables are most accurately interpreted as capturing the effects of changes in those variables within states over time. The vector of year indicators ($\delta_t$) captures the unexplained variation in IPT over time, attributable to unmeasured time-varying cyclical or other market determinants.

Table 2 displays the regression results, with fixed-effects model results in the first three columns and random effects in the fourth. In the first column, only the unemployment rate (quadratic) and the year dummies are included as explanatory variables. Observations are weighted by each state's average employment over the sample period. These results indicate that the IPT rate has a strong cyclical

[18] In preliminary analyses, we incorporated data on health benefit costs, available at the state level from 2006 forward (excluding 2007) from the Medical Expenditure Panel Survey (MEPS, produced by the Agency for Healthcare Research and Quality). These measures had essentially no effect on the incidence of part-time work or the contribution of other explanatory factors in our empirical models restricted to the available time period. We therefore chose to exclude this factor from the analyses and use the longer timeframe enabled by the availability of the other variables. Health benefit costs do not vary with hours worked and as such are quasi-fixed (Montgomery 1988; Lettau and Buchmueller 1999; Euwals and Hogerbrugge 2006; Dolfin 2006). While this will tend to increase employer costs associated with part-time labor, the resulting shift away from part-time labor will be offset to some degree by employers' ability to exclude part-time workers from health benefit plans or offer them lower quality plans. These conflicting influences may explain the limited effects of health insurance costs in our preliminary analyses.

[19] The mining and logging sectors are very small and for several states are not separately distinguished from the construction sector in the state payroll employment data. For consistency, we incorporate mining and logging employment into the construction sector for all states.

component, measured by the coefficients on the unemployment rate and its quadratic term, which are large and precisely estimated. The estimated year effects indicate a persistent upward drift in the overall incidence of IPT employment over time (conditional on annual state unemployment rates) with the largest aggregate year effect evident for the final sample year of 2014.

Compared with column 1, column 2 of Table 2 adds controls for the observable characteristics of state labor markets that are likely to affect the relative demand and supply for IPT employment. Various sub-components of the labor cost, industry share, and demographic variable groups have meaningful effects on the incidence of IPT work (based on coefficients that attain conventional levels of statistical significance). The incidence of IPT work is positively related to changes in the real median wage and the shares of leisure and hospitality employment, other services employment (mainly personal services), and the population share of individuals age 55-64.[20] IPT work is negatively related to changes in the employment shares of the construction, wholesale, financial, and professional/business services sectors, and also the population shares for women age 25-34, men age 35-54, and all individuals age 65 and over. These effects are broadly consistent with the theoretical considerations discussed in Section III. We discuss the size and interpretation of the contributions of the market variables further in section V.

Importantly, inclusion of the explanatory market factors greatly attenuates the otherwise unexplained increase in aggregate IPT work over time. The estimated aggregate year effects since the Great Recession are much smaller in column 2 than in column 1, and they are generally stable in size and statistically insignificant from 2010 forward. However, meaningful residual cyclical effects are reflected in the statistically significant coefficients on the year dummies in 2008 and 2009.

The final two columns of Table 2 provide results from alternative specifications, for robustness checks and comparison.

[20] The positive coefficient on the real median wage variable on involuntary part-time work suggests that this relationship reflects the effects of employer labor costs rather than more general labor demand influences; the latter would tend to increase wages and also reduce IPT work by inducing employers to increase hours worked, in part by relying more heavily on full-time labor.

In column 3, the specification from column 2 is repeated, but with each state given equal weight in the regression. The comparison across columns indicates that the estimated coefficients change only slightly when equal weighting is used, and the broad results are essentially unchanged. In particular, the unexplained year effects in column 3 are slightly reduced in size but roughly similar to those in column 2, confirming that the importance of the state market effects as explanatory factors is not sensitive to whether or not large states receive more weight in the estimation.

The final column of Table 2 presents results from a specification for which the unobserved state effects are assumed to be random and hence not systematically related to the other explanatory variables. The results deviate meaningfully from the fixed-effects regressions in the preceding two columns. The effects of some variables such as the median hourly wage essentially disappear and the effects of others such as the retail trade employment share become much larger and quite precisely estimated. In this specification, the year effects remain positive and significant, indicating an increase in IPT associated with the recession and slow recovery that is not explained by the other features of state labor markets included in the regressions.

We place little emphasis on the random effects results in column 4 because they do not account for unobserved, persistent characteristics of state labor markets that may distort the other estimates. For example, states that consistently have relatively strong labor markets are likely to exhibit higher wages as well as lower rates of involuntary part-time work. This systematic relationship will impart a downward bias to the estimated effect of changes in the median wage on IPT in column 4. Similarly, the share of the retail trade sector in total employment changed little over our sample frame (see Table 1, Section II), suggesting that the estimated effect of this sector's employment in column 4 reflects the influence of states that have persistently high levels of retail employment. By accounting for such time-invariant state effects while allowing all observables to change over time, the fixed-effects regressions provide more reliable estimates of the factors contributing to the change in aggregate IPT employment over time. As

expected based on these differences in estimates between the column 3 and 4 models, the Hausman test for comparison of the two models strongly rejects the random effects specification in column 4 in favor of the fixed-effects specification in column 3.[21]

***B. CPS Individual Data***

We further explore the determinants of part-time work using regressions that rely on CPS individual microdata (initially discussed in Section II). This provides a check on the state level results. In addition, because we have direct information on voluntary as well as involuntary part-time work in the CPS data, we are able to compare and contrast their determinants.

Our analysis of the CPS individual data is based on multinomial logit regressions. In particular, we estimate the determinants of VPT and IPT employment based on the following equation:

$$\Pr(PT_{ist} = j) = \alpha + f(U_{st})\beta + X_{st}\gamma + Z_{ist}\lambda + \varphi_s + \delta_t + \mu_{ist} \qquad (5)$$

The possible *PT* (part time) outcomes *j* are VPT or IPT. Individuals are indexed by *i*, with state of residence *s* and observation year *t*. This equation is similar to equation 3, estimated using the state panel data in the preceding sub-section (we use the same symbols for convenience). However, our individual data enables incorporation of individual controls, denoted Z, with estimated coefficients λ. We include a detailed set of individual controls and hence do not report their coefficient estimates.[22] The coefficients for the VPT and IPT outcomes are estimated jointly using a multinomial logit equation, with full-time work as the omitted (base) category. The standard errors are clustered by state.

[21] The Hausman test statistic is 142.9 (d.f.=33), which is well above the critical value (approximately 55) corresponding to the 1% confidence level for rejecting the null that the random effects estimates are consistent.
[22] Specifically, we incorporate the effects of seven age categories by gender and marital status (28 total categories), five educational attainment categories, five race/ethnic categories, military veteran status, and 13 major industries. Results for the individual controls are available on request.

The results are listed in Table 3. We provide four different specifications, numbered 1-4, with the coefficient estimates for the VPT and IPT components labeled as "a" and "b" respectively. Similar to column 1 of Table 2, model 1 includes only the state unemployment rate and the year effects. Relative to that specification, and in cumulative sequence, model 2 incorporates the individual controls, model 3 incorporates the measured state market factors, and model 4 incorporates unmeasured state effects (incorporated as a complete set of indicator variables).

The results for the most basic specification, model 1, show modest pro-cyclicality in the VPT rate and the expected counter-cyclicality in the IPT rate (the negative and positive coefficients on the unemployment rate in columns 1a and 1b, respectively). As expected, the IPT results in column 1b of Table 3 also show the same strong upward drift over time as the state panel results in column 1 of Table 2 Adding individual controls (model 2) strengthens the measured counter-cyclicality for the IPT rate and also its upward drift over time, suggesting that composition effects associated with differing state business cycle conditions are important contributors to variation in IPT employment.

The key models add state market effects (model 3) and explicit state dummies (model 4). We focus first on the results for the IPT component (columns 3b and 4b). Inclusion of the state market effects largely eliminates the upward drift in IPT work (column 3b), consistent with the fixed effects results using the state panel data in Table 2. The measured effects of the state market variables are roughly similar to those from our preferred specification using the state data (column 2 of Table 2) when state dummies are incorporated (column 4b of Table 3). This is to be expected, since model 4 is essentially an individual level variant of the state fixed-effects specification. Some variation in the effects of industry shares is evident across the state panel and individual data settings, although the important effects of the employment shares of the construction, wholesale trade, and other services sectors are quite consistent.

One notable deviation between the individual and state panel results is that the proportion of individuals age 16-24 in the state population is associated with significantly lower incidence of IPT in the

individual model with full controls (model 4 in Table 3), whereas it had no statistically meaningful effect in the state panel regressions (Table 2). This likely reflects the importance of adjusting for individual age when estimating the effects of the age distribution of the population. In particular, a state with a high proportion of young workers will tend to have a high rate of IPT work because of its high rate in that group. However, having a high share of young workers may reduce the tendency for other age groups to be involuntary part-time workers. The underlying market effect on IPT can only be accurately estimated when the age of individual workers is included in the analysis.

Turning to voluntary part-time work, the effects of the various factors generally are different for VPT than for IPT work. Incorporation of the individual effects (model 2) attenuates the estimated cyclical and time effects on VPT, in contrast to strengthening these effects for IPT employment. Focusing on the model with full controls (model 4), no cyclical pattern in VPT is evident based on the coefficients on the unemployment rate, nor do the year effects indicate any drift over time. Higher state minimum wages tend to increase the VPT rate, suggesting that the income effects of a higher minimum wage outweigh the substitution effect and cause some low-wage workers to prefer part-time to full-time work; however, this effect is imprecisely estimated. Higher employment shares for selected industries are associated with lower VPT incidence, notably for the construction, manufacturing, information, professional/business services, and education/health services sectors.

Overall, the results from regressions using the individual CPS data (Table 3) confirm the key conclusions from the state panel analysis (Table 2). The absence of meaningful residual time effects in models 3 and 4 in Table 3 indicates that changes in IPT work over time are largely explained by variation associated with overall labor market slack (state unemployment rates) and other state market factors. We turn to a quantitative analysis of the contribution of these factors in the next section.

## V. Decomposition and Discussion of Contributory Factors

The regression analyses in the preceding section identified cyclical and other market-based factors that contributed to variation in IPT employment over our sample period of 2003-2014. In this section, we examine the quantitative contributions of the modeled factors to the movements in the aggregate IPT rate over time. We use the state panel data results from Section IV-A for this exercise and calculate how the predicted aggregate IPT rate varies over time based on observed variation in the explanatory variables measured at the state level. For example, we can obtain the estimated contribution of changing state unemployment rates to the aggregate IPT rate, relative to a base year labeled $t_o$, using the following equation:

$$\Delta IPT_U = \sum[(U_{st} - U_{st_0})\beta_1 + (U_{st}^2 - U_{st_0}^2)\beta_2] \quad (6)$$

The β's are the estimated coefficients on the unemployment rate and its squared term from the regression reported in column 2 of Table 2. This expression represents the change in the aggregate IPT rate due to the change in state unemployment rates between year $t_0$ and year $t$. The summation is over the sample observations in year t, weighted by each state's share of total U.S. employment averaged over the sample frame. The contributions of the other factors in the model—labor costs, industry employment shares, and population shares—are obtained similarly. Because the dependent IPT variable is subjected to a nonlinear (log-odds) transformation prior to estimation, we applied a uniform rescaling to the contributions of each factor to ensure that the components sum to the observed change in the actual IPT rate. We use 2006 as our base year, setting all components to zero in that year.

Figure 4 depicts the broad results from this analysis. The figure decomposes the change over time in the aggregate IPT rate into the components due to changes in state unemployment rates and the year effects ("cyclical") and the complete set other measured state market factors (labor costs, industry shares,

and population shares). We include the year effects in the cyclical component because the regression results in Table 2 (column 2) and Table 3 (column 4b) indicate modest cyclicality in the residual year effects on the IPT rate, with statistically significant year coefficients evident during the recession. The chart displays the actual IPT rate and the counterfactual IPT rates predicted by changes in the state unemployment rates and year effects relative to their 2006 values ("variation due to cyclical component") and changes in the state market factors relative to their 2006 values ("variation due to market factors").

Figure 4 shows that the cyclical component accounts for most of the variation over time in the aggregate IPT rate, raising it by about 2 percentage points between its low in 2006 and its peak in 2009-2010. This component has declined along with state unemployment rates and the dissipation of the residual year effects; in 2014 it was down to about 0.9 percentage points above its pre-recession level. By contrast, after a similar sharp rise during the recession, the contribution from the market factors has declined only slightly, keeping the aggregate IPT rate elevated by about 1.2 percentage points in 2014. Together, these two broad components explain the approximate 2 percentage-point elevation in the 2014 IPT rate relative to its 2006 value.

Table 4 provides a more detailed breakdown of the contributions from the market factors. The first column displays the total contribution of these factors and the subsequent three columns display their separate contributions, with their percentage contributions shown in parentheses. Because the total contribution was very small in the early sample years, we only display the estimates for 2006 forward in the table. The key contribution to the total market effect comes from industry composition, although demographics have a moderate net impact as well. From 2010-2014, industry composition accounted for about 70-80 percent of the combined market and year effects, versus about 15-20 percent for demographics. Despite the significant effect of the real median wage in the regression, labor costs make a minor contribution to variation in the IPT rate over time, because the real median wage has changed little over our sample frame.

These results indicate that persistent changes in industry employment shares at the state level have made important contributions to the persistently elevated level of IPT employment since the Great Recession. Further decomposition of the Table 4 results focusing on specific industries shows that the construction sector made the single largest contribution, accounting for about 40 percent of the total industry effect in 2013-14 (results available on request). The interpretation of the construction contribution is not straightforward. In particular, the descriptive statistics in Table 1 show that the construction sector tends to have high rates of IPT employment, yet the regression results in Tables 3 and 4 suggests the opposite: the negative coefficient on the construction employment share implies that states with falling construction shares tend to have higher rates of overall IPT employment.

The contribution of the construction sector in the regressions may reflect the severity of the economic downturn in states most affected by the associated boom and bust in the construction sector. As such, some portion of the industry share effect from Table 4 may be more properly interpreted as a cyclical factor rather than a persistent market effect. On the other hand, the unusually high construction employment leading up to the recession may have contributed to low IPT employment in states with the largest construction boom. Because a return to similar vigorous conditions in the U.S. residential construction sector appears unlikely, it is likely that the impact of the declining construction employment shares will prove to be durable. Moreover, excluding construction, the contribution of changes in the employment shares of other industries is meaningful, and in conjunction with changing population demographics explains nearly a percentage point of the elevated IPT rate in 2013 and 2014.

## VI. Discussion and Conclusions

We analyzed the determinants of involuntary part-time (IPT) employment, focusing on its unusually elevated levels as a share of total employment during and after the U.S. Great Recession of 2007-2009. Other recent research pointed to elevated levels of IPT during this period but did not reach

definitive conclusions about the relative role of cyclical variation and other factors (Cajner et al. 2014; Canon et al. 2014). By contrast, our regression and decomposition methodology enables a relatively precise decomposition of contributory factors. Using state panel and individual CPS data for the period 2003-2014, we confirmed that the IPT rate depends heavily on cyclical variation in labor market conditions. However, we also identify slower moving market factors, reflected mainly in industry employment shares and population demographics, which account for ongoing elevation in the IPT rate despite the cyclical recovery in the labor market. These market or structural factors account for about a percentage point or more of the elevated IPT share of total employment through 2014. The contribution of these factors declined only slightly during the recovery period following the recession. These results suggest that the incidence of IPT employment, and the BLS U6 measure of labor market underutilization that incorporates IPT workers, may remain well above their pre-recession lows as the labor market expansion continues.

In related work, Even and Macpherson (2015) examined the contribution of employer anticipation of the ACA employer health benefit mandate to IPT employment in recent years. Exploiting the expected differential effects of the mandate across industries, they find that employers' anticipatory responses can explain most or all of the unusual elevation in the IPT rate. Their finding of important cross-industry effects may relate to the substantial role of industry employment shares that we find in our own analysis. Additional research that compares and reconciles these finding would be useful.

Our framework and findings suggest other avenues for future work as well. We focused on recent empirical patterns in involuntary part-time work, discussing a market demand and supply framework for broad guidance only. More formal modeling of the demand and supply sides of the market for part-time work, and its general equilibrium properties, could be quite valuable for refining these findings. The wage effects of such changes are of particular interest and perhaps could be identified by focusing on industries with high incidence of part-time work, such as the retail and hospitality sectors.

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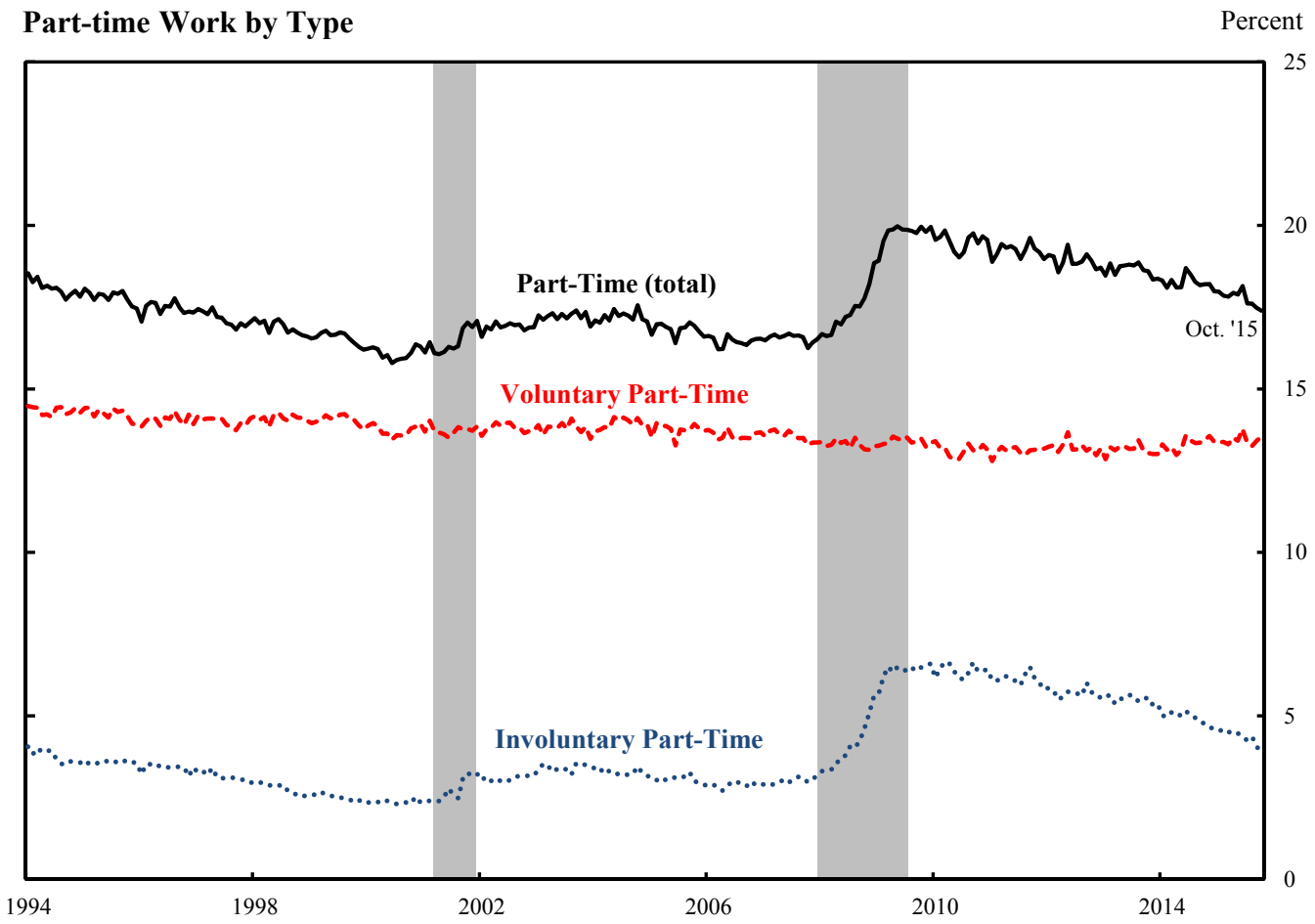
## Figure 1

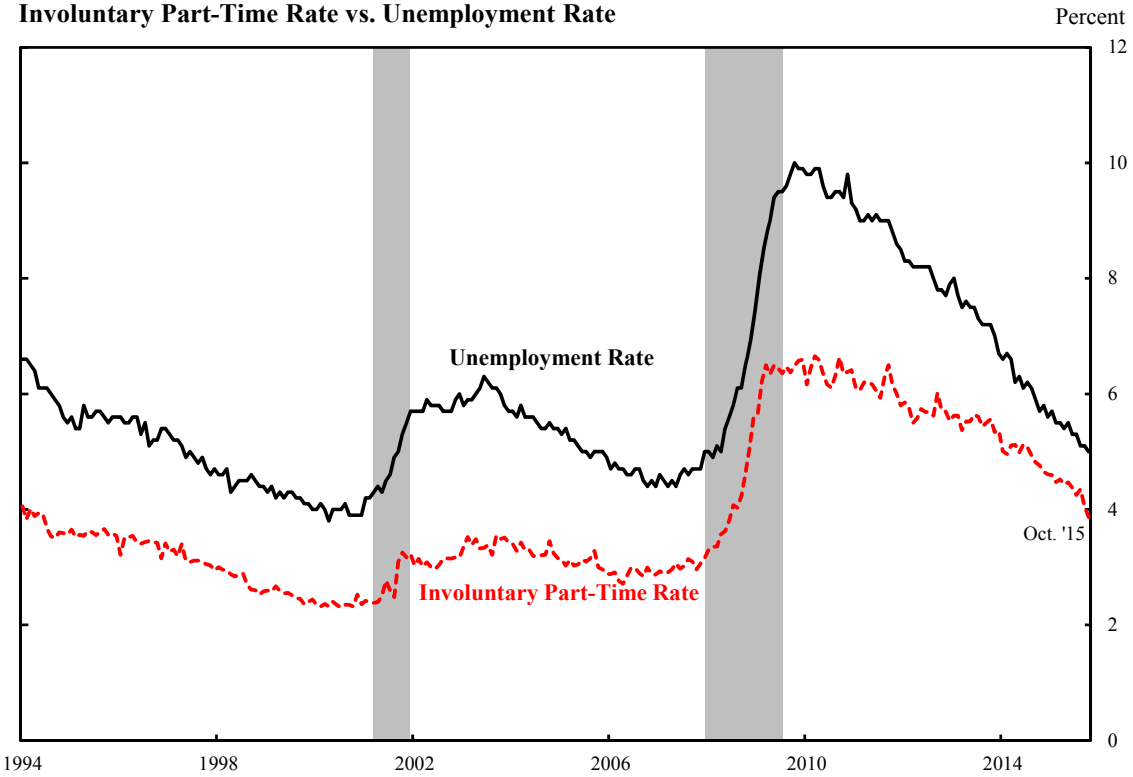
**Part-time Work by Type**




Source: BLS and authors' calculations. Part-time rates expressed as a share of total civilian employment.

## Figure 2
## Panel A

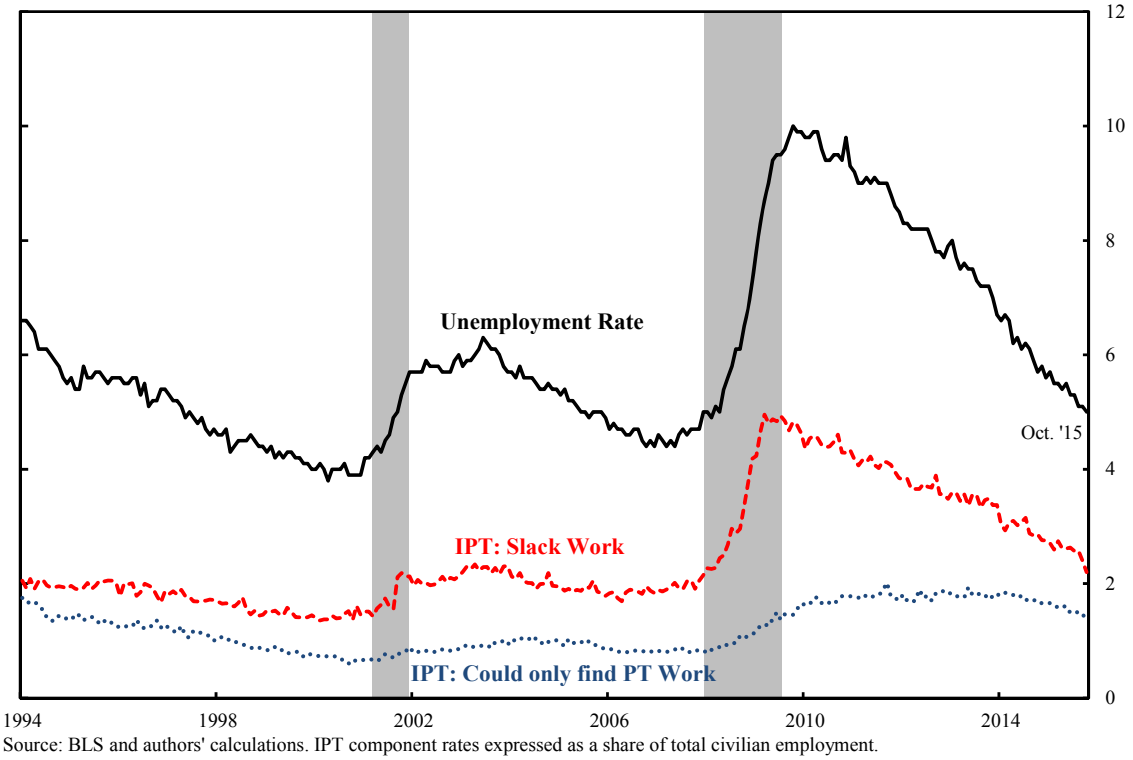
**Involuntary Part-Time Rate vs. Unemployment Rate**




Source: BLS and authors' calculations. Involuntary part-time rate expressed as a share of total civilian employment.

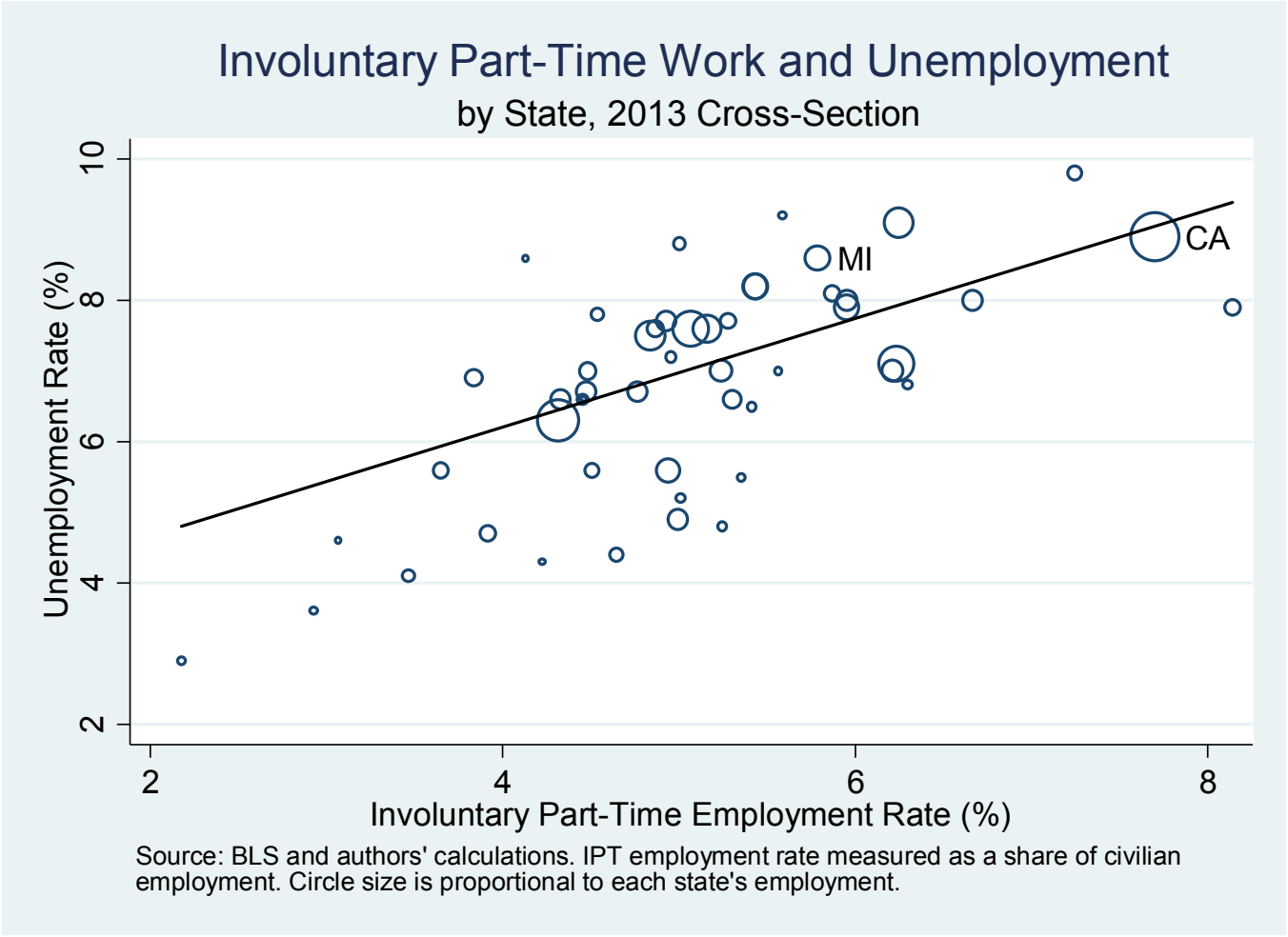
## Panel B

**Unemployment and Involuntary Part-Time (IPT) Components**



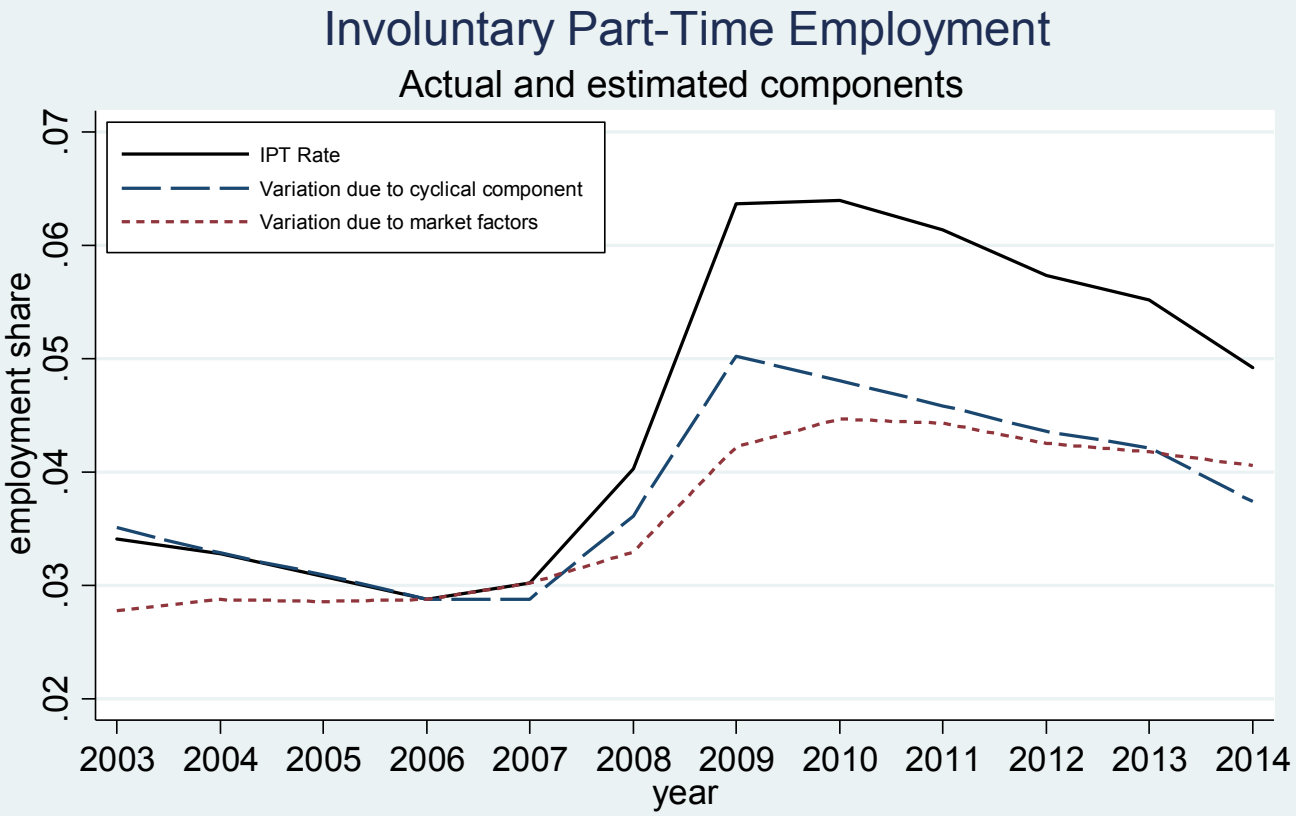

Source: BLS and authors' calculations. IPT component rates expressed as a share of total civilian employment.

**Figure 3**




Source: BLS and authors' calculations. IPT employment rate measured as a share of civilian employment. Circle size is proportional to each state's employment.

**Figure 4**




Note: Authors' calculations from fixed-effects regressions (results from column 2 of Table 2). Cyclical component includes unemployment and year effects. Series are measured as shares of civilian employment.

**Table 1: Part-Time Work by Labor Market Group and Sector (incidence by group)[1]**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| | Voluntary Part-time Workers | | Involuntary Part-Time Workers | | Sum: Voluntary + Involuntary Part-Time Workers | | Memo: Employment Share[2] | |
| **Individual Characteristics** | **2003** | **2014** | **2003** | **2014** | **2003** | **2014** | **2003** | **2014** |
| **All Workers** | 0.139 | 0.131 | 0.034 | 0.049 | 0.173 | 0.180 | 1.000 | 1.000 |
| **Demographic Category (gender/age)** | | | | | | | | |
| All 16-24 | 0.352 | 0.356 | 0.061 | 0.097 | 0.413 | 0.453 | 0.153 | 0.133 |
| Men 25-34 | 0.033 | 0.046 | 0.036 | 0.048 | 0.069 | 0.093 | 0.126 | 0.124 |
| Women 25-34 | 0.146 | 0.136 | 0.035 | 0.059 | 0.182 | 0.194 | 0.106 | 0.107 |
| Men 35-54 | 0.020 | 0.022 | 0.022 | 0.031 | 0.042 | 0.053 | 0.245 | 0.225 |
| Women 35-54 | 0.150 | 0.128 | 0.031 | 0.045 | 0.182 | 0.173 | 0.233 | 0.208 |
| All 55-64 | 0.128 | 0.107 | 0.026 | 0.037 | 0.153 | 0.145 | 0.110 | 0.159 |
| All 65+ | 0.447 | 0.340 | 0.023 | 0.031 | 0.470 | 0.371 | 0.026 | 0.044 |
| **Education Level** | | | | | | | | |
| Less than High School | 0.250 | 0.234 | 0.067 | 0.094 | 0.317 | 0.328 | 0.118 | 0.083 |
| High School | 0.117 | 0.116 | 0.042 | 0.066 | 0.158 | 0.182 | 0.305 | 0.269 |
| Some College | 0.165 | 0.169 | 0.029 | 0.049 | 0.194 | 0.218 | 0.289 | 0.298 |
| Bachelor's | 0.096 | 0.089 | 0.017 | 0.028 | 0.113 | 0.117 | 0.195 | 0.228 |
| More than Bachelor's | 0.084 | 0.082 | 0.012 | 0.017 | 0.096 | 0.099 | 0.093 | 0.122 |
| **Race/ethnicity** | | | | | | | | |
| White | 0.153 | 0.141 | 0.027 | 0.039 | 0.181 | 0.180 | 0.703 | 0.647 |
| Black | 0.101 | 0.109 | 0.043 | 0.067 | 0.144 | 0.176 | 0.112 | 0.119 |
| Hispanic | 0.099 | 0.113 | 0.060 | 0.075 | 0.158 | 0.188 | 0.121 | 0.147 |
| Asian/Pacific Islander | 0.124 | 0.113 | 0.030 | 0.040 | 0.154 | 0.153 | 0.043 | 0.059 |
| Other | 0.148 | 0.145 | 0.054 | 0.067 | 0.202 | 0.212 | 0.020 | 0.027 |
| **Broad Industry** | | | | | | | | |
| Mining | 0.028 | 0.018 | 0.013 | 0.009 | 0.041 | 0.027 | 0.004 | 0.008 |
| Construction | 0.046 | 0.042 | 0.054 | 0.061 | 0.100 | 0.102 | 0.064 | 0.057 |
| Manufacturing | 0.030 | 0.033 | 0.022 | 0.020 | 0.052 | 0.053 | 0.136 | 0.113 |
| Wholesale Trade | 0.065 | 0.047 | 0.015 | 0.019 | 0.080 | 0.067 | 0.033 | 0.026 |
| Retail Trade | 0.220 | 0.216 | 0.047 | 0.089 | 0.267 | 0.305 | 0.120 | 0.118 |
| Transportation/utilities | 0.067 | 0.065 | 0.028 | 0.038 | 0.095 | 0.103 | 0.052 | 0.053 |
| Information | 0.104 | 0.095 | 0.021 | 0.029 | 0.125 | 0.124 | 0.029 | 0.022 |
| Financial activities | 0.093 | 0.066 | 0.014 | 0.017 | 0.107 | 0.083 | 0.071 | 0.068 |
| Professional/business services | 0.107 | 0.087 | 0.037 | 0.043 | 0.144 | 0.130 | 0.092 | 0.107 |
| Leisure & hospitality | 0.308 | 0.298 | 0.079 | 0.115 | 0.387 | 0.413 | 0.087 | 0.095 |
| Education & health services | 0.191 | 0.163 | 0.025 | 0.038 | 0.215 | 0.202 | 0.215 | 0.236 |
| Other services | 0.232 | 0.221 | 0.044 | 0.067 | 0.276 | 0.288 | 0.045 | 0.045 |
| Public administration | 0.047 | 0.045 | 0.007 | 0.013 | 0.054 | 0.059 | 0.052 | 0.052 |

Note: Authors' calculations using CPS microdata. Sample includes nonagricultural wage and salary workers age 16 and over who worked positive hours in the survey week and whose hours data were not allocated.

[1] Numbers in first six columns represent share of all employed individuals for the row category who are in the column category of part-time work (by year).

[2] Share of row group in total employment (part-time and full-time).

**Table 2: Involuntary Part-Time Regression Results, 2003-2014**
**(fraction of state civilian employment; log-odds transformation)**

| Variables (by category) | (1) Fixed Effects | (2) Fixed Effects (with market factors) | (3) (2) unweighted | (4) Random Effects |
|---|---|---|---|---|
| **Cyclical** | | | | |
| Unemployment Rate | 0.249*** | 0.144*** | 0.175*** | 0.226*** |
| | (0.016) | (0.017) | (0.019) | (0.017) |
| Unemployment Rate Squared/100 | -0.820*** | -0.465*** | -0.646*** | -0.847*** |
| | (0.089) | (0.087) | (0.101) | (0.101) |
| **Year (2006 omitted)** | | | | |
| 2003 | -0.047** | 0.069** | 0.106*** | 0.048 |
| | (0.020) | (0.034) | (0.033) | (0.029) |
| 2004 | -0.017 | 0.041* | 0.062** | 0.027 |
| | (0.019) | (0.024) | (0.025) | (0.025) |
| 2005 | -0.007 | 0.029 | 0.027 | 0.002 |
| | (0.018) | (0.018) | (0.021) | (0.022) |
| 2007 | 0.048*** | 0.000 | -0.002 | 0.023 |
| | (0.018) | (0.019) | (0.022) | (0.022) |
| 2008 | 0.152*** | 0.110*** | 0.099*** | 0.128*** |
| | (0.020) | (0.027) | (0.030) | (0.027) |
| 2009 | 0.214*** | 0.158*** | 0.156*** | 0.218*** |
| | (0.031) | (0.049) | (0.053) | (0.044) |
| 2010 | 0.183*** | 0.084 | 0.065 | 0.169*** |
| | (0.032) | (0.061) | (0.066) | (0.052) |
| 2011 | 0.206*** | 0.078 | 0.057 | 0.160*** |
| | (0.030) | (0.066) | (0.069) | (0.054) |
| 2012 | 0.225*** | 0.085 | 0.061 | 0.160*** |
| | (0.027) | (0.070) | (0.070) | (0.054) |
| 2013 | 0.265*** | 0.100 | 0.064 | 0.169*** |
| | (0.025) | (0.076) | (0.074) | (0.055) |
| 2014 | 0.306*** | 0.081 | 0.015 | 0.137** |
| | (0.021) | (0.083) | (0.078) | (0.056) |
| **Market Factors** | | | | |
| Labor Costs | | | | |
| Median hourly wage | - | 0.058*** | 0.041** | -0.000 |
| | | (0.017) | (0.018) | (0.010) |
| State Minimum Wage | - | -0.012 | -0.102 | -0.057 |
| | | (0.181) | (0.210) | (0.192) |
| Industry Shares | | | | |
| Construction | - | -0.084*** | -0.062*** | -0.035*** |
| | | (0.014) | (0.014) | (0.009) |
| Manufacturing | - | -0.025* | -0.034** | -0.003 |
| | | (0.015) | (0.016) | (0.006) |
| Wholesale trade | - | -0.219*** | -0.251*** | -0.008 |
| | | (0.049) | (0.055) | (0.022) |

(Continued)

Table 2 (continued)

| | (1) Fixed Effects | (2) Fixed Effects (with market factors) | (3) (2) unweighted | (4) Random Effects |
|---|---|---|---|---|
| Retail trade | | -0.006 | -0.036 | 0.059*** |
| | | (0.032) | (0.033) | (0.015) |
| Transportation/utilities | - | 0.044 | 0.072** | 0.021 |
| | | (0.038) | (0.032) | (0.017) |
| Information | - | -0.020 | 0.049 | 0.095*** |
| | | (0.040) | (0.043) | (0.028) |
| Financial activities | - | -0.063** | -0.037 | -0.022* |
| | | (0.031) | (0.033) | (0.013) |
| Professional/business services | - | -0.044** | -0.019 | 0.010 |
| | | (0.021) | (0.020) | (0.009) |
| Leisure & hospitality | - | 0.081*** | 0.059** | 0.028*** |
| | | (0.028) | (0.029) | (0.007) |
| Education & health services | - | 0.015 | 0.026 | 0.010 |
| | | (0.019) | (0.019) | (0.008) |
| Other services | - | 0.131*** | 0.102** | 0.025 |
| | | (0.041) | (0.042) | (0.022) |
| Population Shares (gender/age) | | | | |
| All 16-24 | - | -0.025 | -0.015 | 0.008 |
| | | (0.016) | (0.015) | (0.013) |
| Men 25-34 | - | 0.091 | -0.005 | -0.016 |
| | | (0.066) | (0.057) | (0.053) |
| Women 25-34 | - | -0.164** | -0.019 | -0.061 |
| | | (0.073) | (0.061) | (0.052) |
| Men 35-54 | - | -0.108* | -0.091 | 0.016 |
| | | (0.060) | (0.055) | (0.043) |
| Women 35-54 | - | 0.043 | 0.086 | -0.098** |
| | | (0.059) | (0.060) | (0.042) |
| All 55-64 | - | 0.053** | 0.063*** | 0.029* |
| | | (0.023) | (0.022) | (0.016) |
| All 65+ | - | -0.066*** | -0.025 | -0.021 |
| | | (0.021) | (0.020) | (0.013) |
| N | 612 | 612 | 612 | 612 |

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

Notes: Standard errors in parentheses. Mean of state civilian employment used for regression weights. Minimum wage scaled by state median hourly wage (nominal), median wage in real terms. Industry shares calculated as a share of total state nonfarm labor force.

**Table 3: Multinomial Logit Regressions, VPT or IPT versus Full Time, 2003-2014**
**(dependent variable indicates VPT, IPT, or full-time status; full time is the omitted category)**

| | (1a) | (1b) | (2a) | (2b) | (3a) | (3b) | (4a) | (4b) |
|---|---|---|---|---|---|---|---|---|
| | (unemployment & year effects only) | | (add individual controls) | | (add state market effects) | | (add state dummies) | |
| | Voluntary Part-Time | Involuntary Part-Time | Voluntary Part-Time | Involuntary Part-Time | Voluntary Part-Time | Involuntary Part-Time | Voluntary Part-Time | Involuntary Part-Time |
| **Cyclical** | | | | | | | | |
| Unemployment Rate | -0.059* | 0.151*** | 0.027 | 0.169*** | -0.002 | 0.218*** | 0.012 | 0.219*** |
| | (0.034) | (0.033) | (0.033) | (0.038) | (0.016) | (0.025) | (0.008) | (0.024) |
| Unemployment Rate Squared/100 | 0.204 | -0.249 | -0.173 | -0.443* | 0.001 | -0.724*** | -0.061 | -0.765*** |
| | (0.214) | (0.193) | (0.232) | (0.240) | (0.088) | (0.147) | (0.049) | (0.152) |
| **Year (2006 omitted)** | | | | | | | | |
| 2003 | 0.077*** | 0.031 | 0.029 | 0.052 | 0.120*** | 0.154*** | -0.015 | 0.068* |
| | (0.021) | (0.036) | (0.021) | (0.035) | (0.030) | (0.038) | (0.022) | (0.037) |
| 2004 | 0.072*** | 0.036* | 0.042*** | 0.055** | 0.102*** | 0.117*** | 0.015 | 0.053** |
| | (0.016) | (0.021) | (0.015) | (0.022) | (0.021) | (0.029) | (0.018) | (0.026) |
| 2005 | 0.041*** | 0.014 | 0.022** | 0.021 | 0.056*** | 0.054*** | 0.008 | 0.024 |
| | (0.010) | (0.015) | (0.010) | (0.015) | (0.012) | (0.016) | (0.011) | (0.018) |
| 2007 | -0.013 | 0.019 | -0.007 | 0.031* | -0.042*** | -0.041* | -0.008 | -0.022 |
| | (0.008) | (0.015) | (0.009) | (0.017) | (0.014) | (0.024) | (0.011) | (0.021) |
| 2008 | 0.020 | 0.142*** | -0.024 | 0.177*** | -0.080*** | 0.026 | -0.032 | 0.045 |
| | (0.017) | (0.025) | (0.016) | (0.027) | (0.026) | (0.041) | (0.020) | (0.029) |
| 2009 | 0.143*** | 0.280*** | 0.027 | 0.389*** | -0.064 | 0.137* | -0.008 | 0.101** |
| | (0.055) | (0.065) | (0.054) | (0.072) | (0.051) | (0.078) | (0.037) | (0.049) |
| 2010 | 0.117** | 0.259*** | 0.009 | 0.373*** | -0.105 | 0.059 | -0.040 | -0.007 |
| | (0.056) | (0.074) | (0.055) | (0.077) | (0.066) | (0.095) | (0.045) | (0.056) |
| 2011 | 0.092* | 0.278*** | -0.000 | 0.386*** | -0.127* | 0.023 | -0.029 | -0.005 |
| | (0.048) | (0.065) | (0.046) | (0.069) | (0.073) | (0.103) | (0.047) | (0.056) |
| 2012 | 0.065 | 0.290*** | -0.011 | 0.384*** | -0.135* | 0.014 | -0.033 | 0.008 |
| | (0.040) | (0.054) | (0.039) | (0.058) | (0.075) | (0.102) | (0.049) | (0.060) |
| 2013 | 0.031 | 0.339*** | -0.029 | 0.424*** | -0.156** | 0.044 | -0.040 | 0.054 |
| | (0.034) | (0.041) | (0.032) | (0.049) | (0.079) | (0.108) | (0.052) | (0.069) |
| 2014 | -0.002 | 0.332*** | -0.028 | 0.397*** | -0.154* | 0.021 | -0.032 | 0.043 |
| | (0.024) | (0.032) | (0.023) | (0.037) | (0.080) | (0.109) | (0.052) | (0.079) |

(Continued)

Table 3 (continued)

| | (1a) Voluntary Part-Time | (1b) Involuntary Part-Time | (2a) Voluntary Part-Time | (2b) Involuntary Part-Time | (3a) Voluntary Part-Time | (3b) Involuntary Part-Time | (4a) Voluntary Part-Time | (4b) Involuntary Part-Time |
|---|---|---|---|---|---|---|---|---|
| **Market Factors (State)** | | | | | | | | |
| Labor Costs | | | | | | | | |
| Median hourly wage | - | - | - | - | 0.050*** | 0.041*** | 0.003 | 0.048** |
| | | | | | (0.013) | (0.014) | (0.014) | (0.020) |
| State Minimum Wage | - | - | - | - | 0.500* | 0.576 | 0.276* | 0.142 |
| | | | | | (0.259) | (0.433) | (0.150) | (0.257) |
| Industry Shares | | | | | | | | |
| Construction | - | - | - | - | 0.009 | -0.021 | -0.034*** | -0.070*** |
| | | | | | (0.015) | (0.020) | (0.012) | (0.016) |
| Manufacturing | - | - | - | - | 0.026*** | 0.017** | -0.031** | -0.023 |
| | | | | | (0.009) | (0.008) | (0.013) | (0.020) |
| Wholesale trade | - | - | - | - | 0.024 | 0.031 | 0.072 | -0.215*** |
| | | | | | (0.025) | (0.031) | (0.045) | (0.065) |
| Retail trade | - | - | - | - | 0.008 | 0.068*** | 0.007 | -0.048 |
| | | | | | (0.027) | (0.025) | (0.031) | (0.038) |
| Transportation/utilities | - | - | - | - | -0.037* | -0.017 | 0.011 | 0.043 |
| | | | | | (0.022) | (0.023) | (0.019) | (0.047) |
| Information | - | - | - | - | 0.038 | 0.091*** | -0.069** | 0.013 |
| | | | | | (0.031) | (0.031) | (0.035) | (0.048) |
| Financial activities | - | - | - | - | -0.014 | -0.017 | -0.043 | -0.057 |
| | | | | | (0.013) | (0.012) | (0.029) | (0.035) |
| Professional/business services | - | - | - | - | 0.020** | 0.021** | -0.049*** | -0.031 |
| | | | | | (0.010) | (0.011) | (0.014) | (0.024) |
| Leisure & hospitality | - | - | - | - | -0.003 | 0.008 | -0.033 | 0.060 |
| | | | | | (0.011) | (0.010) | (0.023) | (0.038) |
| Education & health services | - | - | - | - | 0.036*** | 0.020** | -0.036** | 0.015 |
| | | | | | (0.009) | (0.010) | (0.018) | (0.022) |
| Other services | - | - | - | - | -0.019 | 0.040 | -0.031 | 0.118** |
| | | | | | (0.027) | (0.026) | (0.028) | (0.049) |

(Continued)

Table 3 (continued)

| | (1a) Voluntary Part-Time | (1b) Involuntary Part-Time | (2a) Voluntary Part-Time | (2b) Involuntary Part-Time | (3a) Voluntary Part-Time | (3b) Involuntary Part-Time | (4a) Voluntary Part-Time | (4b) Involuntary Part-Time |
|---|---|---|---|---|---|---|---|---|
| Population Shares (gender/age) | | | | | | | | |
| All 16-24 | - | - | - | - | -0.006 | -0.008 | -0.025 | -0.044*** |
| | | | | | (0.017) | (0.025) | (0.019) | (0.016) |
| Men 25-34 | - | - | - | - | -0.039 | -0.045 | -0.047 | -0.067 |
| | | | | | (0.095) | (0.110) | (0.043) | (0.065) |
| Women 25-34 | - | - | - | - | -0.168* | -0.164* | 0.034 | 0.028 |
| | | | | | (0.087) | (0.089) | (0.046) | (0.075) |
| Men 35-54 | - | - | - | - | 0.037 | 0.116 | -0.052 | -0.063 |
| | | | | | (0.056) | (0.071) | (0.050) | (0.063) |
| Women 35-54 | - | - | - | - | -0.159*** | -0.305*** | 0.050 | 0.052 |
| | | | | | (0.056) | (0.069) | (0.048) | (0.057) |
| All 55-64 | - | - | - | - | 0.021 | 0.095*** | -0.010 | 0.074*** |
| | | | | | (0.026) | (0.031) | (0.017) | (0.023) |
| All 65+ | - | - | - | - | -0.046*** | -0.061*** | 0.023 | -0.043* |
| | | | | | (0.017) | (0.019) | (0.015) | (0.024) |
| Individual Controls | No | | Yes | | Yes | | Yes | |
| State Dummies | No | | No | | No | | Yes | |
| N | 7625063 | | 7625063 | | 7625063 | | 7625063 | |
| Log Likelihood | -4340188.2 | | -3516853.3 | | -3504579.7 | | -3500200.9 | |
| Pseudo-R2 | 0.005 | | 0.193 | | 0.196 | | 0.197 | |

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

Notes: Standard errors (clustered by state) in parentheses. Sample includes nonagricultural wage and salary workers at work last week whose hours were not allocated. Individual controls include age (7 categories)*gender*marital status interactions, education level (5), race/ethnicity (5), veteran status, and major industry (13). See Table 2 for notes on state market factors.

| Table 4: Decomposition of structural/market effects, 2006-14 | | | | |
|---|---|---|---|---|
| (from weighted fixed-effects regression in column 2 of Table 2; **percent contribution in parentheses**) | | | | |
| | (1) | (2) | (3) | (4) |
| Year | Total structural effect | Industry composition | Age/gender composition | Labor costs |
| 2006 | 0.000 | 0.000 | 0.000 | 0.000 |
| | | (0.000) | (0.000) | (0.000) |
| 2007 | 0.001 | 0.001 | 0.000 | 0.000 |
| | | (0.506) | (0.326) | (0.168) |
| 2008 | 0.004 | 0.003 | 0.001 | 0.000 |
| | | (0.697) | (0.212) | (0.091) |
| 2009 | 0.013 | 0.010 | 0.002 | 0.002 |
| | | (0.741) | (0.144) | (0.115) |
| 2010 | 0.016 | 0.012 | 0.003 | 0.002 |
| | | (0.744) | (0.161) | (0.095) |
| 2011 | 0.016 | 0.011 | 0.003 | 0.001 |
| | | (0.729) | (0.200) | (0.072) |
| 2012 | 0.014 | 0.011 | 0.002 | 0.001 |
| | | (0.783) | (0.171) | (0.046) |
| 2013 | 0.013 | 0.010 | 0.002 | 0.000 |
| | | (0.806) | (0.158) | (0.036) |
| 2014 | 0.012 | 0.010 | 0.002 | 0.000 |
| | | (0.828) | (0.140) | (0.032) |

Note: See text Section V for description of decomposition methodology.

**Appendix A: State Data Sources and Definitions**

The definitions and sources for the primary variables used in the state-level panel analysis are as follows.

1) **Involuntary part-time employment (IPT) rate.** We formed this variable using annual averages from the state labor force and labor underutilization series, available from 2003 forward from the BLS Local Area Unemployment Statistics (LAUS) program: http://www.bls.gov/lau/stalt_archived.htm. The IPT rate as a share of civilian employment is calculated by backing it out from the underutilization series U5 and U6 (which includes the IPT group) along with the employment and labor force series.
2) **Unemployment rate.** This is also obtained from the BLS LAUS program.
3) **Labor costs**:
    a) **Real median wage**. Median hourly wage data for each state are from the BLS Occupational Employment Statistics (OES, http://www.bls.gov/oes/tables.htm) program, using data for all occupations for each year. The median wage was deflated for analysis using the PCE GDP deflator.
    b) **Minimum wage**. Minimum wages are compiled from the US Department of Labor minimum wage historical tables (http://www.dol.gov/whd/state/stateMinWageHis.htm). When there is no listed minimum wage for a year for a particular state, the most recent listed minimum wage for that state is used. If there are no data for a state at all or the legislated state minimum is below the US minimum, the US minimum wage is used. When a range is listed (in the case that different laws apply to different types of enterprises), then the upper bound is used.
4) **Industry employment shares.** Shares are calculated using BLS state payroll employment data, available at: http://www.bls.gov/sae/tables.htm.

5) **Population shares by age/gender.** These are calculated using the latest available post-censal population estimates released by the U.S. Bureau of the Census. For example, the 2000s data use the 2009 vintage of post-censal estimates, and 2010s data use the 2014 vintage. Historical data are available at http://www.census.gov/popest/data/historical/index.html, and current estimates are available at http://www.census.gov/popest/data/index.html.