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Part and Full-Time Employment Over the Business Cycle

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Abstract

We develop a model that allows us to understand the cyclicality of part and full-time employment. In the model, labor market frictions generate a surplus between workers and firms, who jointly decide whether their employment relationship is best suited for part or full-time work based on match quality shocks and the broader economic environment. Lower acyclical costs cause the surplus of part-time matches to vary less with the business cycle than the surplus of full-time matches. As a consequence, the model is able to generate procyclical full-time employment and countercyclical part-time employment as observed in the data. We also show that ignoring part-time employment understates the impact on employment and inequality of a recession and that subsidizing part-time work is far more effective than increasing unemployment insurance at preventing a labor market downturn.

JEL Classification: D8, J6, D6
Keywords: bargaining, matching,

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1 Introduction

The Great Recession and the recent Covid-19 experience have emphasized the importance of closely monitoring part-time work.[1] This is the case as it can provide additional information regarding the performance of an economy.[2] If part-time is ignored, aggregate unemployment numbers may understate the true economic slack over the business cycle. Within the context of a labor search framework, this is the case as worker flows across different employment states are critical in shaping unemployment dynamics.[3] But, is part-time employment an important feature of the labor market? Are its associated dynamics different to those of full-time employment?

Since the mid-1990s slightly more than one in six U.S. civilian employees worked in jobs classified as part-time. In the last decade, this share rose from about 17% in 2007 to nearly 20% in 2009. Not only part-time employment has been quantitatively important, its business cycle properties have also been rather different.[4] Over the last four decades, full-time employment has been highly procylical, while part-time employment has been acylical or slightly countercyclical. We have also observed a lot of within-job transitions between part and full-time employment. In particular, workers have transitioned from full-time to part-time employment (6.5% monthly) more frequently than from full-time work to unemployment (0.7% monthly). These flows have not been symmetric. In an expansion workers have transitioned from part-time to full-time, while in a recession we have observed a flow from full-time to part-time employment.[5] Similar labor market regularities have been documented by Canon et al. (2014), Borowczyk-Martins and Lalé (2019) and Borowczyk-Martins and Lalé (2020), among others.

In this paper we propose a framework that can account for these empirical regularities. By considering a more granular treatment of employment, we are able to better understand the mechanisms driving employment flows and shed light some important aggregate labor market phenomena. In particular, we provide answers to the following questions: How much of the part and full-time employment rates over the business cycle is directly caused by aggregate shocks relative to the endogenous adjustments made by firms? What do we miss when part-time employment is ignored? Does an expansion of the unemployment insurance during a recession

[1]The U.S. Bureau of Labor Statistics (BLS) classifies part-time employment as a situation where workers are employed fewer than 35 hours per week.

[2]Federal Reserve Chair Yellen (2014) noted that the elevated number of workers who are employed part-time but desire full-time work might imply that the degree of resource underutilization in the labor market is greater than what is captured by the standard unemployment rate. Additional information can be found in Yellen (2014).

[3]Workers who report that they are working part-time for economic reasons rise almost in lock step with the increase in unemployment and the decline in full-time employment. This regularity is observed in virtually all developed countries.

[4]We refer the reader to Borowczyk-Martins and Lalé (2019) and the data section for more details.

[5]We refer the reader to Section 3 for more details on the empirical regularities of full and part-time employment.

increase overall employment and output relative to a "job-subsidy" scheme?

To answer these questions, we propose a framework that builds on Mortensen and Pissarides (1994). In particular, we consider firms offering part and full-time employment. When hiring, employers face differential acyclical fixed costs that differ across employment types.[6] Given a productivity of a match, firms and workers choose the type of employment. Conditional on such arrangement, firms and workers contract wages through bargaining. Over time, matches are subject to idiosyncratic shocks, which may cause the match to dissolve or transition to the other employment state. Given this structure, we estimate the model using simulated method of moments, matching key labor market targets. We then perform a series of counterfactual exercises to answer the previous questions. Finally, we consider the effectiveness of different labor market policies, that are revenue neutral, at limiting the size and duration of downturns in the labor market. In particular, we compare the labor market and output consequences of implementing an extension of unemployment insurance during a recession versus a "job-subsidy" scheme.

We find that our framework is capable of matching the degree of cyclicality in nearly all flows in the labor market, though it does not match the magnitudes of the fluctuations. In particular, the model delivers the observed flows and hours of part-time and full-time employment in the data. We also show that the majority of flows between part and full-time are caused by adjustments in the endogenous separation thresholds. In particular, the part-time separation threshold is less cyclical than the full-time one. This results in full-time employment being procyclical and part-time employment being countercyclical. We are also able to capture the differences in labor market outcomes when agents face small and large recessions. In particular, in smaller recessions (such as the 2001 recession) part-time employment can absorb much of the drop in full-time employment. This is not the case for larger recessions (such as the Great recession of 2007) and substantial drops in both types of employment is observed. Key for our results is the fact that fixed costs are lower for part-time employment. As a result, full-time surplus expands proportionally more during expansions, while it shrinks during contractions.

To determine the major source of cyclicality generated by our framework, we consider several counterfactual experiments. When only idiosyncratic shocks are considered, the cyclicality of separations increases substantially. In contrast when firms are allowed to adjust away from its steady-state value, the cyclicality of flows into unemployment are reversed, and job-finding rates become nearly acyclical.

Differences, over the business cycle, between part and full-time employment partly reflect an

[6] Mortensen and Nagypal (2007) also showed that training costs increase the volatility of job finding. Part and full-time employment are critically shaped by legislation, resulting in different costs and legal requirements. For instance, in the U.S., full-time jobs often offer paid time-off and employer-sponsored retirement programs. Moreover, employing firms are required to provide health insurance to workers. These features are not present in part-time employment arrangements.

additional margin of adjustment. Thanks to part-time employment and in response to fluctuations in demand for firms' output, employers can vary the intensity of labor utilization without having to fire/hire new workers.[7] In economic downturns, reducing hours of current employees allows employers to avoid layoffs and save on future hiring and training costs. Moreover, during recessions workers have lower outside options, so they are more likely to accept a part-time job. On the other hand, in booms hiring is more difficult due intense competition for workers. Thus, firms have an incentive to increase the working hours of current employees by offering full-time employment.[8] Our findings highlight that these margin of adjustment are relevant for aggregate labor market outcomes. In particular, when the economy enters into a recession, we show that environments without part-time employment understate the size of the decline in labor market employment and their effect on workers.

Finally, taking into account the different policies implemented during Covid-19, we consider the effectiveness of extending an unemployment insurance during a recession versus a "job-subsidy" scheme.[9] In particular, we impose a 7% decline in aggregate productivity and implement different labor market policies that are revenue neutral. First, we institute a 20% increase in unemployment benefits. Then, we consider a job subsidy. Despite small changes in each acyclical costs, both job-subsidy policies recover more rapidly and suffer a smaller decline than an expansion of unemployment insurance. In particular, we find that the economy with the part-time subsidy nearly has no decline in employment despite a drop in aggregate productivity of 7%. On the other hand, the full-time job subsidy scheme results in a larger decline in employment and output than the part-time subsidy. Nevertheless, it also performs better than an expansion of unemployment insurance.

2 Literature Review

This paper contributes to the literature of part and full-time employment. Within the empirical literature, Canon et al. (2014) find that part-time workers for economic reasons are typically less educated than full-time and are typically employed in middle or low-skill occupations.[10] In the

[7]There exists ample empirical evidence that firms hire part-time workers as a form of flexible labor. Using Canadian firm-level data, Zeytinoglu (1992) finds that organizational flexibility is a major argument to hire part-time workers. On the basis of international firm-level data, Delsen (1995) finds that the introduction of part-time employment has led to positive outcomes for firms in several European countries.

[8]Using firm-level data, Friesen (1997) shows that part-time work plays a distinct role in the adjustment strategies of UK firms.

[9]In the U.S. and Australia, among other countries, during Covid-19 policymakers have enacted increases in unemployment insurance and "job-subsidy" schemes.

[10]On average, part-time workers for economic reasons (PTER) workers earn 19 percent less than full-time workers and 9 percent less (per hour) than part-time workers for non-economic reasons (PTNER), even after controlling for sociodemographic and occupational characteristics. The differences persist if we compare wages of PTER to wages of other workers within broad occupational categories.

aftermath of the 2007-09 recession, Canon et al. (2014) also find that changes in the transition probabilities to and from part-time worker for economic reasons were mainly associated with changes in the composition of employment.[11] Using a Markov chain model, Borowczyk-Martins and Lalé (2019) find similar results for the U.S. and United Kingdom. In particular, the authors show that cyclical variation in hours per worker is driven to a large extent by fluctuations in the share of part-time employed workers.[12] Borowczyk-Martins and Lalé (2019) also find that the bulk of the variation in the part-time employment share is accounted for by cyclical fluctuations in transition rates between full-time and part-time work.[13] They also show that the incidence of involuntary part-time employment among new part-time workers increases dramatically in recessions, and is mostly driven by full-time workers facing slack work conditions. Valletta et al. (2020) find that structural factors, notably shifts in the industry composition of employment, have held the incidence of involuntary part-time work slightly more than 1 percentage point above its pre-recession level. Using these insights, Borowczyk-Martins and Lalé (2020) develop an adjustment procedure to construct U.S. monthly time series of involuntary part-time employment stocks and flows since 1976. The authors establish that involuntary part-time employment is a very transitory labor market state.[14] Its main source of variation is found to be cyclical and it is predominantly driven by within-employment reallocation.[15] Finally, Borowczyk-Martins and Lalé (2020) also find that fluctuations in involuntary part-time employment flows exhibit systematic patterns over the business cycle.

Within the context of a theoretical model, Chang et al. (2011) construct a family model of labor supply that considers full and part-time employment. Individuals are subject to idiosyncratic shocks that affect their productivity in market work. The authors assume that there is a wage penalty associated with part-time work and can be gender specific.[16] A representative firm produces output according to a constant-returns-to-scale Cobb-Douglas technology in capital and efficiency units of labor. Using simulated data from the steady state of the calibrated model, Chang et al. (2011) find positive estimated elasticities that are larger for women and that are highly significant, but they bear virtually no relationship to the underlying preference parameters. Within a different framework, and closest to our spirit, Warren (2015) models part-time work focusing on a firm's decision to hire, fire, or partially utilize its labor force.

[11] The authors used counterfactual exercises similar to Shimer (2012).

[12] This holds for the major recessions of the past five decades in the U.S. and for the Great Recession in the United Kingdom.

[13] The authors also find that cyclical variation in transitions between full-time and part-time work is predominantly accounted for by transitions at the same employer. Moreover, transitions between full-time and part-time work at the same employer entail sizable and lumpy adjustments in individual working hours.

[14] An average spell lasts about 30% less than an average unemployment spell.

[15] Transitions to and from full-time and voluntary part-time employment account for just over three quarters of the short-run variation in involuntary part-time work.

[16] These assumptions can help capture the fact that men and women have differential labor supply across occupations.

Firms are heterogeneous in size and productivity, and subject to search frictions. The model produces patterns of part-time utilization by firms over the age, size, and employment growth distribution. Firm-level utilization of part-time employment is consistent with the characteristics of worker flows in the CPS. In aggregate, the model matches the relative volatility of unemployment and part-time for economic reasons over the business cycle. Part-time labor utilization by firms increases the volatility in vacancies and unemployment in the model relative to the case with only an extensive margin. Finally, Borowczyk-Martins and Lalé (2018) analyze differences in involuntary part-time work and unemployment spells through the lens of the incomplete-market and job-search model of Acemoglu and Shimer (2000). The authors consider two sources of insurance against idiosyncratic labor market risks. There is private insurance through a risk-free asset where the worker can save but cannot borrow. In addition, there is public insurance against the risk of becoming unemployed. Since the authors are only interested in the worker's decision problem, all prices (interest rates, wages, etc.) are exogenous and fixed. A calibration of this environment, consistent with U.S. institutions and labor market dynamics, shows that involuntary part-time work generates lower welfare losses relative to unemployment.

We complement these papers by proposing a simple framework framework of part and full-time employment that can capture the cyclicality of various employment flows. We also determine whether business cycle is directly caused by aggregate shocks relative to the endogenous adjustments made by firms. We also highlight what is missing when part-time employment is ignored.

3 Empirical Regularities

Before delving into the model in this section we document regularities about the cyclicality of part and full-time employment. We use these facts to inform key aspects of our theoretical framework. We also use this data to discipline the choice of structural parameters describing the economy.

Throughout, the data considered in this paper is the Current Population Survey (CPS) that spans from 1996 to 2019. This is the standard data set used to explore employment over time in the US. We impose standard sample restrictions, limiting our data to white prime-age males with a Bachelors Degree or less.

3.1 Cyclicality of Part and Full-Time Utilization

We start by using the CPS to document regularities about the relationship between cyclicality of part and full-time employment and aggregate employment. In Figure 3.1 we plot aggregate employment, which is depicted in the left panel. We disaggregate this measure by part and full-time status in the left panel; where part-time is given by the green line and full-time by the solid red line. The unemployment rate (blue line with long dashes) is shown in the right panel.

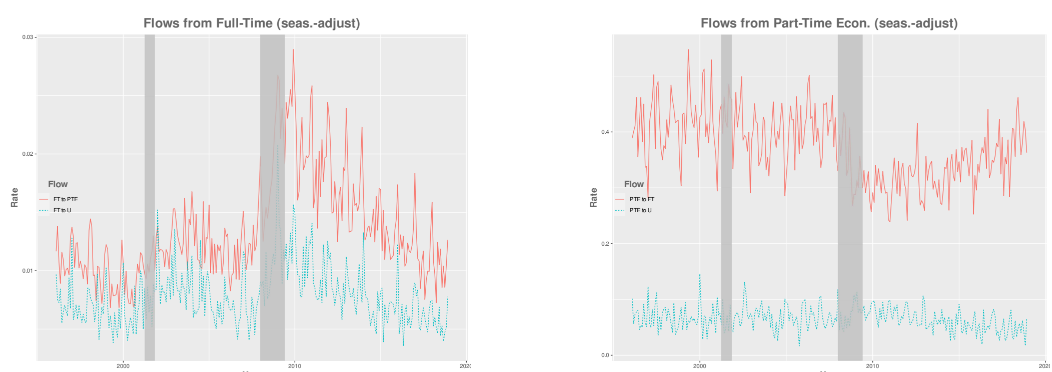
(a) Aggregate employment rate. Source: CPS.

(b) Employment rates by type. Source: CPS.

Figure 3.1: Employment rates between 1996 and 2018.

As Figure 3.1 shows, full-time employment is procyclical, while part-time work and unemployment are both countercyclical. Because full-time work contributes the most to the total number of jobs, aggregate employment is then procyclical.

The previous employment aggregates could have been generated by a variety of different flows. To provide additional insights to these employment patterns, we also document how flows between part and full-time employment evolve during the business cycle. In particular, Figure 3.2 reports the gross transition rates out of part and full-time employment. In the left panel we plot flows from full-time to part-time employment and from full-time employment to unemployment. In the right panel we report the time series of flows from part-time to full-time employment and part-time employment to unemployment.



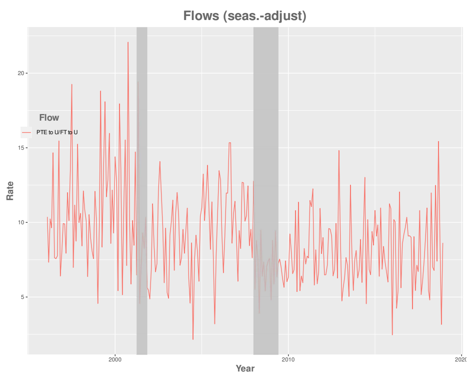
(a) Flows from full-time employment. Source: CPS.

(b) Flows from part-time employment. Source: CPS.

Figure 3.2: Employment flows

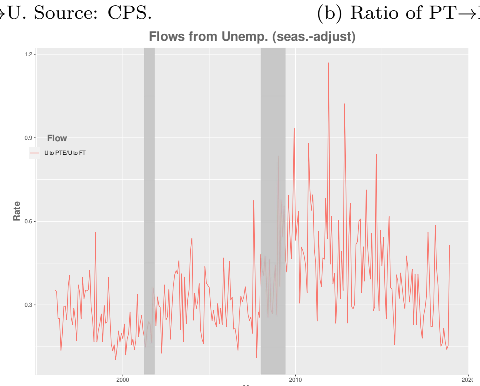
Figure 3.2 clearly shows that flows out of full-time employment are countercyclical, while flows from part-time to full-time employment are procyclical. In contrast, flows from part-time employment to unemployment are acyclical.

To provide some insight into the source of cyclicality for both full and part-time employment, we analyze how the ratio of flows varies over the business cycle. In the left of Figure 3.2 we depict the ratio of part-time to unemployment flows relative to full-time to unemployment flows, both as a fraction of employment in their respective type. In the right panel, we present the ratio of part-time to full-time flows relative to full-time to part-time flows. Finally, in the bottom panel, we plot the ratio of flows from unemployment to part-time and full-time employment.



(a) Ratio of PT→U to FT→U. Source: CPS.

(b) Ratio of PT→FT to FT→PT. Source: CPS.



(c) Ratio of U→FT to U→PT. Source: CPS.

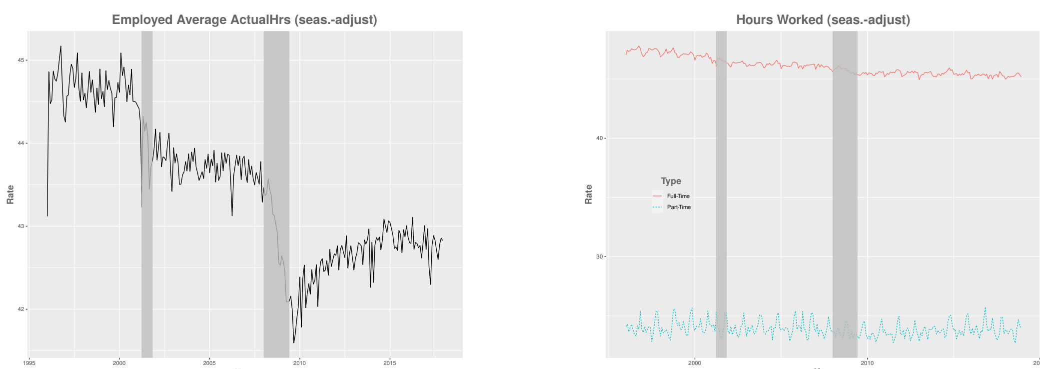
Figure 3.3: Ratios of employment flows.

As we can see from Figure 3.3, as a fraction of employment, part and full-time flows to unemployment are roughly constant over the business cycle. However, only during the Great Recession, these ratios slightly decrease. In contrast, the ratio of flows between employment status are strongly procyclical.Thus, we can conclude that these flows are the main source of the observed cyclicality. Similarly, flows out from unemployment are strongly procyclical, mirroring the pattern of flows to and from full-time employment. We also find that the ratio of flows between part and full-time employment are roughly equal to the ratio of flows to unemployment times the ratio of the flows from unemployment. These findings suggest that the same factors that drive the flows between part and full-time employment also drive the flows out of unemployment.

3.2 Differences Between Part and Full-Time Work

Our findings here as well as in Borowczyk-Martins and Lalé (2018), Warren (2015), among others, suggest that modeling part and full-time employment requires more nuance than traditional intensive margins of adjustment. While utilization fluctuates in ways consistent with continuous adjustment of hours, observed adjustment of hours tends to be "lumpy," with few workers actually congregating at the 35 hour a week margin. In addition, as we discuss subsequently, these jobs differ along a few key dimensions.

Although many papers mainly exploit the pure intensive margin to capture the procyclicality of aggregate hours, closer inspection shows that most of this fluctuation is caused by movements between part and full-time employment. Figure 3.4 shows that decomposing the labor force between full and part-time work is critical in determining the major source of fluctuations. The left panel plots the full-time employment, part-time employment, and the unemployment rates. The right panel plots the average hours for full and part-time workers over the same time period.



(a) Average hours worked weekly from 1994 to 2017 for employed workers. Source: CPS.

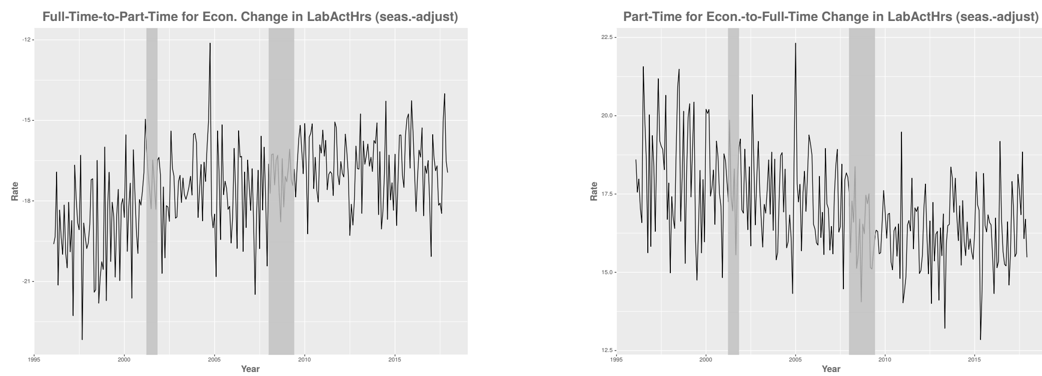
(b) Average hours worked weekly from 1994 to 2017 by utilization. Source: CPS.

Figure 3.4: Hours worked over time by utilization.

Figure 3.4 shows that although hours are procyclical, very little of its fluctuation is captured by a traditional intensive margin. Instead, the bulk of the change in hours worked are driven by movements between part and full-time employment over the business cycle. This is a point also emphasized by Borowczyk-Martins and Lalé (2019), who note that the majority of these flows are within employer.[17]

[17] Warren (2015) also notes that the majority of flows between part and full-time work is within employers.

To gain a deeper insight about these facts, Figure 3.5 depicts the flows between full and part-time work on the average working hours a worker who experiences such flow.



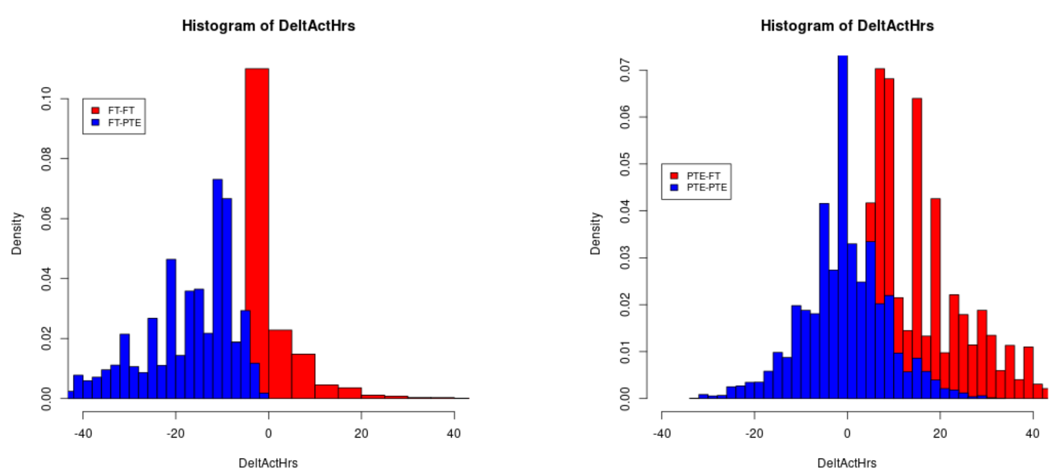
(a) Change in hours worked from FT-PTE utilization change over time. Source: CPS.

(b) Change in hours worked from PTE-FE utilization change over time. Source: CPS.

Figure 3.5: Changes in hours worked over time.

Surprisingly, neither of the flow series displays any cyclicality. Moving from full-time to part-time employment results in an average reduction of 18 hours. While this number varies over time, it does not co-move with the business cycle. Similarly, moving from a job that was part-time to a full-time job entails a gain of roughly 17.5 hours. This increase in hours worked also does not co-move with the business cycle. Moreover, the variability in hours for part or full-time workers is minimal. Noticeable changes are only observed when a worker shifts from full to part-time work or vice versa.

This latter observation is captured in Figure 3.6. In particular, the left panel plots a histogram of hours changes for full-time workers, highlighting changes to part-time work. Instead, the right panel does the same for part-time work.



(a) Changes in hours, FT-FT vs. FT-PTE. Source: CPS.

(b) Changes in hours, PTE-PTE vs. PTE-FT. Source: CPS.

Figure 3.6: Histogram of hours changes.

This figure suggests that moving to part-time employment is more than just a mere intensive margin adjustment. This change entails a sizable loss of hours.

In addition to hours, what other differences do we observe between part and full-time employment? Jepsen (2001) finds that part-time jobs require fewer skills, and thus less training than full-time jobs. This training is often firm-specific, and entails a cost, in the event of separation, that is shared by both parties. Research also suggests that training is acyclical or mildly procyclical as in Mendez and Sepulveda (2012). Furthermore Bonamy and May (1997) find that part-time work is often inefficient because it can create communication gaps. As a result, it may produce a lower surplus for firms. Additional fixed costs (such as administrative costs, provision of fringe benefits, etc.) are independent of hours. Thus, they increase non-linearly with the amount worked as argued by Montgomery (1988).

Consistent with prior work, we also document in Figure 3.7 that the cost of providing benefits to part-time workers is both acyclical and consistently lower than the cost of providing benefits to full-time workers, even on an hourly basis.

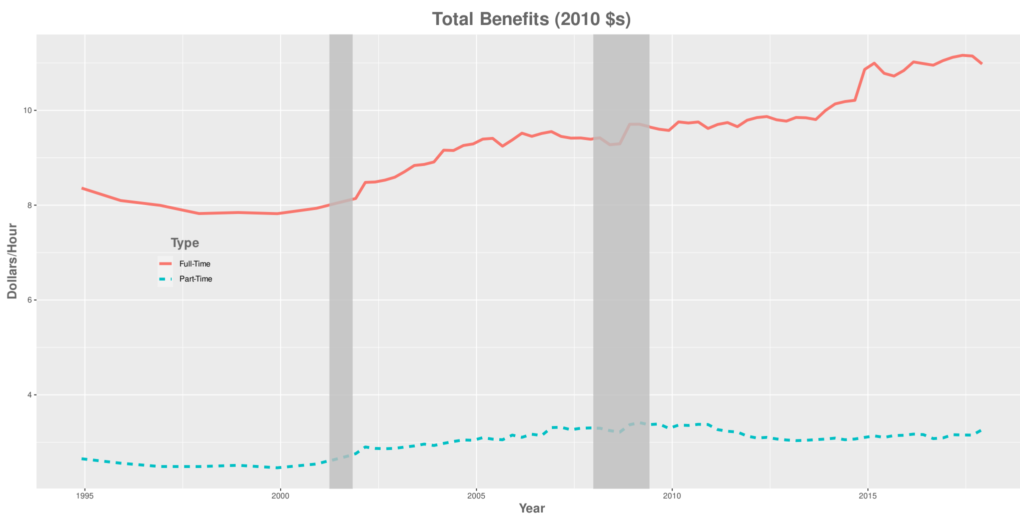


Figure 3.7: Cost of Total Benefits (Hourly)

These benefits may be available to the unemployed, provided inefficiently, or never used by workers, leading to a deadweight loss in the surplus. Taken together, these differences suggest that part-time work and full-time work yield different levels of output, entail different costs, that these costs may be sunk in the event of unemployment, and that they are largely acyclical.

Summarizing, the evidence presented in this Section suggests that, when developing the theoretical framework to understand the labor market, full and part-time employment should be treated as two separate employment states. We are not alone in recognizing this dichotomy in the data: Chang et al. (2011), Borowczyk-Martins and Lalé (2018), and Warren (2015), among others, suggest that modeling part and full-time employment requires more nuance than traditional intensive margins of adjustment. Our findings here also suggests that the framework should treat hours worked, within these two employment types, as fixed. Changes in hours are "lumpy," where traditional models that optimize over a continuous choice of hours would suggest continuous jumps in hours. In addition, the part and full-time job appear to have different characteristics despite frequent within job transitions between utilization and these differences are often acyclical. Next we present a model that incorporates these features, which can be used to better understand part and full-time employment over the business cycle.

4 Framework

We extend Mortensen and Pissarides (1994) to incorporate part and full-time work. Upon meeting, firms and workers choose optimally whether their match is best served with full-time work, part-time work, or by both parties pursuing other matches. They contract on both a wage and employment schedule by bargaining, given the productivity of a match. There is a unit mass of atomistic workers, and an infinite mass of atomistic firms. Time is continuous, and the payoff flow for both firms and workers is discounted at rate r. Workers may be either unemployed and receive flow utility b, or employed and receive a flow payout w, which depends on match characteristics. Firms may be unmatched, and waiting to match with a worker, or matched and receiving flow profits $z\epsilon Y_T - w - \tau_T$, where ϵ is a match-specific component, z is a common aggregate shocks, Y_T is the type-specific productivity. τ_T is an acyclical cost that depends on employment type, but not aggregate productivity. In our benchmark model, we consider the steady-state equilibrium and perform comparative statics on the aggregate component. After characterizing the existence of part and full-time employment, we generalize the model to include out of steady-state dynamics.

Firms can open a vacancy to attract a worker at cost κ, but ex ante do not know whether the match will result in full or part-time work. Workers match randomly with posting firms. We assume that there exists a constant returns to scale matching technology, $M(u, v)$, that is common to all labor market participants. Following the common convention, we define u as the stock of unemployed workers and v as the stock of vacancies. The matching function determines the number of matches as well as the worker-finding rate for firms, $\frac{M(u,v)}{v} = M(\frac{u}{v}, 1) \equiv q(\theta)$, and the job-finding rate of workers, $\frac{M(u,v)}{v} \equiv p(\theta) = \theta q(\theta)$, where θ denotes labor market tightness, $\theta = \frac{v}{u}$.

Workers and firms is ex ante identical, but experience shocks for the duration of a match. Upon meeting, workers realize an iid match-specific productivity draw from a common distribution $\epsilon \sim F(\epsilon)$, which evolves over the duration of the match at a rate λ_T, depending on whether they are part or full-time. After observing the match-specific productivity realization, firms and workers jointly decide whether the match should result in part-time employment, full-time employment, or continued search for a different match. Below some productivity threshold ϵ_P, a worker would prefer to continue searching for employers, while the firm would similarly prefer to open a new vacancy and search for a better suited worker. A draw above this threshold ensures that the match will continue (the first margin), but the type of match remains to be determined. Above a second productivity threshold, ϵ_F, workers and firms choose to make the job full-time. Draws between ϵ_P and ϵ_F result in part-time employment. After determining the type of employment, firms and workers agree on a schedule of wages according to a surplus splitting rule (Nash Bargaining), and a schedule of hours that maximize the surplus of the match. Each of the wage, the hours, and the employment type (part or full-time) may change in response to productivity shocks.

At any point, an idiosyncratic productivity shock may realize and alter the employment relationship. Workers and firms continue to follow the wage and hours schedule, but the job may transition from full-time to part-time employment, should a realization $\epsilon' \in [\epsilon_P, \epsilon_F)$, $\epsilon \geq \epsilon_F$ occur, or part-time to full-time if $\epsilon' \geq \epsilon_F$, $\epsilon \in [\epsilon_P, \epsilon_F)$. Similarly, the match may realize a productivity shock $\epsilon' < \epsilon_P$, in which case the match dissolves.

We assume that part and full-time jobs operate different production technologies, $Y_P < Y_F$. In addition to different production technologies, part and full-time matches incur different flow costs that are required to ensure the continuation of a match, τ_P, and τ_F, for part and full-time employment, respectively, with $\tau_P \leq \tau_F$. We do not take an explicit stand on the interpretation of these costs, and interpret them as a composite of costs associated with maintaining fixed capital, training workers to use production technologies, taxes that would not be incurred in the absence of a match, and required benefits that are either provided in unemployment or involve dead-weight loss in their acquisition. For analytical simplicity, we assume that these costs differ only by employment type, and that they are acyclical. Initially, we assume that the aggregate state is stationary, $z = \bar{z}$, but we relax this assumption when we simulate the model.

4.1 Benchmark Model

We first describe an environment where workers may be unemployed, or employed either in full or part-time work. Within this environment, unemployed workers receive flow utility that is given by:

$$r\, U = b + \gamma + p(\theta) \int (\max\{W^F(x), W^P(x), 0\} - U)\, dF(x); \tag{4.1}$$

where $T \in \{P, F\}$ indexes part and full-time employment. Unemployed workers match with firms at a rate $p(\theta)$, and transition to employment if the realized productivity $\epsilon \geq \epsilon_P$. When matched they receive the following flow value:

$$r\, W^T(\epsilon) = w + \lambda_T \alpha \int (\max\{S^F(x), S^P(x), 0\} - S^T(\epsilon))\, dF(x); \tag{4.2}$$

where w is the wage and λ_T is the rate at which the match experiences idiosyncratic productivity shocks. It is worth emphasizing that a full-time worker may transition to part-time, and vice-versa, depending on the idiosyncratic productivity level of the match. Within a match, workers transition from full to part-time work when $\epsilon' < \epsilon_F$ and from employment to unemployment when $\epsilon' < \epsilon_P$.

Unfilled vacancies receive the following flow value:

$$r\ V = -\kappa + q(\theta) \int (\max\{J^F(x), J^P(x), 0\} - V)\ dF(x)). \tag{4.3}$$

where $q(\theta)$ is the contact rate of workers. Firms pay a flow cost of κ until they meet a worker, and they continue to enter until it is no longer profitable. These features yield the free entry condition:

$$q(\theta) = \frac{\kappa}{\int \max\{J^F(x), J^P(x), 0\}\ dF(x)}. \tag{4.4}$$

Once matched, firms receive the following flow value:

$$r\ J^T(\epsilon) = z\epsilon Y_T - \tau_T - w + \lambda_T(1-\alpha) \int (\max\{S^F(x), S^P(x), 0\} - S^T(\epsilon))\ dF(x); \tag{4.5}$$

where $z\epsilon Y_T$ is the output associated with a type $T = \{P, F\}$ employed worker, and τ_T is the corresponding firm's flow cost, $\tau_T = \{\tau_P, \tau_F\}$, depending on whether the match results in full or part-time employment, respectively. Without loss of generality, we focus on environments where $\epsilon_F \geq \epsilon_P$.

In any match, the surplus given productivity ϵ, and type T, is wages and profits, net of outside options and costs:

$$S^T(\epsilon) = W^T(\epsilon) - U + J^T(\epsilon) - V \tag{4.6}$$

$$= W^T(\epsilon) - U + J^T(\epsilon) \tag{4.7}$$

after imposing the free entry condition ($V = 0$). Substituting Equation 4.2, Equation 4.1, and Equation 4.5 into this expression, and using the free entry conditions and surplus sharing rules yield the following expression for the surplus:

$$\begin{aligned}(r + \lambda_T)\ S^T(\epsilon) = {} & z\epsilon Y_T - \tau_T \\ & + \lambda_T[\int_{\epsilon_F}^{\bar{\epsilon}} S^F(x) dF(x) + \int_{\epsilon_P}^{\epsilon_F} S^P(x) dF(x)] - b - \frac{\alpha}{1-\alpha}\theta\kappa\end{aligned} \tag{4.8}$$

Given ϵ_P and ϵ_F, net worker flows into part-time employment, $\dot{e}^P$, full-time employment,

$\dot{e}^F$, and unemployment, $\dot{u}$, are given by:

$$\dot{e}^P = (P(\theta)u + \lambda_F e^F)[F(\epsilon_F) - F(\epsilon_P)] - (\lambda_P[1 - F(\epsilon_F) + F(\epsilon_P)])e^P \tag{4.9}$$

$$\dot{e}^F = (P(\theta)u + \lambda_P e^P)[1 - F(\epsilon_F)] - (\lambda_F F(\epsilon_F))e^F \tag{4.10}$$

$$\dot{u} = \lambda_P F(\epsilon_P)e^P + \lambda_F F(\epsilon_P)e^F - p(\theta)[1 - F(\epsilon_P)]u. \tag{4.11}$$

For simplicity we assume that exogenous separations are zero, but relax this assumption in our calibration.

4.2 Characterization of Equilibrium

Any equilibrium in this model is characterized by a wage function, w, a market tightness θ, and thresholds ϵ_P and ϵ_F. There are additional transition rates $\dot{e}^F$, $\dot{e}^P$, and $\dot{u}$, and associated stocks e^F, e^P, and u for full-time and part-time employment, and unemployment, respectively. These functions satisfy

1. θ is determined by vacancy posting and is consistent with the free entry condition.
2. ϵ_P is the threshold productivity at which firms and workers are indifferent between remaining matched.
3. ϵ_F is the threshold productivity at which firms and workers are indifferent between part and full-time work.
4. Wages w are determined by Nash Bargaining over the surplus of a match with worker bargaining power α.
5. The employment rates are consistent with employment flows and both are consistent with worker and firm decisions.

4.2.1 Steady-State Equilibrium

We focus on the steady-state in our benchmark model. The steady-state is defined by a policy tuple $(\epsilon_P, \epsilon_F, \theta, w^*, h^*)$, and steady-state employment rates e^{P*}, e^{F*}, u^*. The policy functions are defined as above, and the employment rates are given by

$$e^P = \frac{(P(\theta)u + \lambda_F e^F)\,[F(\epsilon_F) - F(\epsilon_P)]}{(\lambda_P[1 - F(\epsilon_F) + F(\epsilon_P)])}; \tag{4.12}$$

$$e^F = \frac{(P(\theta)u + \lambda_P e^P)\,[1 - F(\epsilon_F)]}{(\lambda_F F(\epsilon_F))}; \tag{4.13}$$

$$u = \frac{\lambda_P F(\epsilon_P)e^P + \lambda_F F(\epsilon_P)e^F}{p(\theta)[1 - F(\epsilon_P)]}. \tag{4.14}$$

4.2.2 Productivity Thresholds and Flows

There are two unique productivity shocks that define separation thresholds, ϵ_F, and ϵ_P. ϵ_F, the productivity above which matches are full-time, and below which matches are part-time is determined by $S^F(\epsilon_F) = S^P(\epsilon_F)$. At this point, a match of productivity ϵ_F is equally-profitable when constituted as either part or full-time employment. The second threshold, ϵ_P, is given by the indifference point between part-time work and unemployment, $S^P(\epsilon_P) = 0$. Figure 4.1 depicts the relationship between these thresholds and the stock of employment across states.

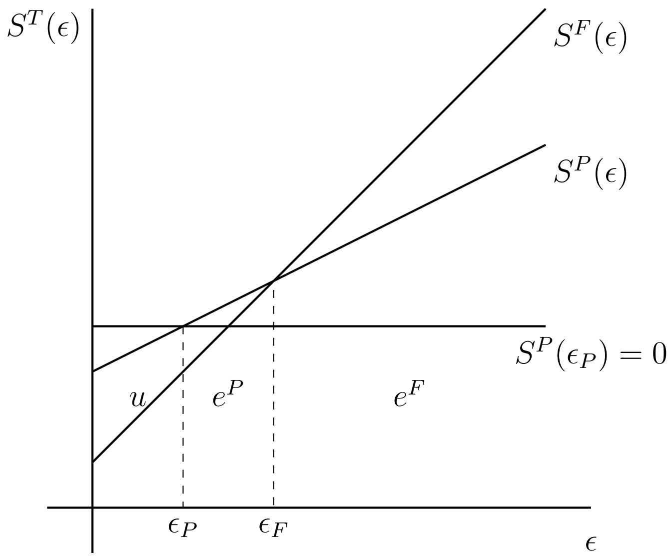


Figure 4.1: Employment Thresholds

Proposition 1. *The full-time threshold is given by*

$$\epsilon_F = \frac{(r+\lambda_P)\tau_F - (r+\lambda_F)\tau_P}{z((r+\lambda_P)Y_F - (r+\lambda_F)Y_P)} + \frac{(\lambda_P - \lambda_F)(b + \frac{\alpha}{1-\alpha}\theta\kappa)}{z((r+\lambda_P)Y_F - (r+\lambda_F)Y_P)}$$
$$+ \frac{\lambda_P(r+\lambda_F)^2 - \lambda_F(r+\lambda_P)^2}{((r+\lambda_P)Y_F - (r+\lambda_F)Y_P)(r+\lambda_P)(r+\lambda_F)}[Y_F \int_{\epsilon_F}^{\bar{\epsilon}} [1 - F(x)]dx + Y_P \int_{\epsilon_P}^{\epsilon_F} [1 - F(x)]dx] \tag{4.15}$$

when $\lambda_P = \lambda_F$,

$$\epsilon_F = \frac{\tau_F - \tau_P}{z(Y_F - Y_P)}. \tag{4.16}$$

Proposition 2. *The part-time threshold is given by:*

$$\epsilon_P = \frac{\tau_P + b + \frac{\alpha}{1-\alpha}\theta\kappa}{zY_P} - \frac{\lambda_P}{r+\lambda_P}[(\frac{Y_F}{Y_P})\int_{\epsilon_F}^{\bar{\epsilon}}[1-F(x)]dx + \int_{\epsilon_P}^{\epsilon_F}[1-F(x)]dx] \tag{4.17}$$

Each threshold provides information on what drives part and full-time employment. For full-time employment, the measure of workers is determined by the difference in cost and productivity with part-time workers. As productivity of full-time increases, ϵ_F falls and more workers move from part to full-time work. When we assume that $\lambda_P = \lambda_F$, it is also easy to see how aggregate shocks will shift this threshold; we explore this further in the next section. The part-time threshold responds both to the cost-benefit ratio for part-time employment (the first line in Equation 4.17), and the continuation value accrued from increases in idiosyncratic productivity and transitions to full-time employment.

4.3 Equilibrium Properties

In this section we explore the model properties. We start by showing that steady-state flows in our model are consistent with our empirical findings in Section 3. Next, we perform a series of comparative statics and show that they are qualitatively consistent with our previous findings. In particular, we focus on transitions between part and full-time employed and show that they can deliver the patterns observed in Figure 3.1b.

4.4 Steady-State Flows

Having defined the productivity thresholds, we can characterize the flows between employment types in the steady state. We are primarily interested in model predictions about the ratio of transitions between employment states that we described in Section 3. We start by characterizing the ratio of flows from part and full-time jobs to unemployment in the steady state.

Proposition 3. *The ratio of the PT→U rate to the FT→U rate is constant and given by:*

$$\frac{\frac{e^{P\to u}}{e^P}}{\frac{e^{F\to u}}{e^F}} = \frac{\lambda_P}{\lambda_F}. \tag{4.18}$$

Consistent with the findings in Section 3, the model predicts a constant ratio of these flows, which is equal to the ratio of the arrival rates of the two shocks. Next, we show the ratio of flows between part and full-time employment.

Proposition 4. *The ratio of the PT→FT rate to the FT→PT rate in the steady-state is given by*

$$\frac{\frac{e^P \to e^F}{e^P}}{\frac{e^F \to e^P}{e^F}} = \frac{\lambda_P[1 - F(\epsilon_F)]}{\lambda_F[F(\epsilon_F) - F(\epsilon_P)]}. \tag{4.19}$$

Further, it is sufficient for flows from part-time to full-time exceed full-time to part time in the steady-state if $\lambda_P > \lambda_F$ *and* $[1 - F(\epsilon_F)] > [F(\epsilon_F) - F(\epsilon_P)]$.

This proposition shows that if we restrict the parameter space, the model is able to replicate the findings in Section 3 that flows from part-time to full-time exceed full-time to part time. In particular, when $\lambda_P > \lambda_F$ and $[1 - F(\epsilon_F)] > [F(\epsilon_F) - F(\epsilon_P)]$ flows from part-time to full-time exceed full-time to part time in the steady-state.

Last, we show that the model predicts that the ratio of flows out of unemployment to full and part-time employment is proportional to flows between part and full-time employment, consistent with our previous empirical findings.

Proposition 5. *The ratio of the U→PT rate to the U→FT rate in the steady-state is given by*

$$\frac{\frac{u \to e^F}{u}}{\frac{u \to e^P}{u}} = \frac{[1 - F(\epsilon_F)]}{[F(\epsilon_F) - F(\epsilon_P)]} \tag{4.20}$$

which is proportional to flows between full and part-time employment (Equation 4.19) without the proportionality factor $\frac{\lambda_P}{\lambda_F}$.

It is worth highlighting that Figure 3.3c shows that this ratio is roughly equal to the ratio of flows from part and full-time employment to unemployment times flows between part and full-time employment. Such pattern is also predicted by our model. In the next section we explore how these flows vary over the business cycle and under what conditions our model will yield results consistent with our findings in Section 3.

4.5 Adjustments over the Business Cycle

Next, we assess employment in our model responds to changes in aggregate productivity by conducting a series of comparative statics. Our model contains two key margins of adjustment that determine employment. One is the utilization threshold, ϵ_F, the other one is the separation threshold, ϵ_P. The magnitude of the response of both thresholds to aggregate shocks dictates how employment adjusts in our economy.

The degree of cyclicality that each threshold exhibits depends upon the cyclicality of rents as well as gains or losses from changes in employment utilization. The following proposition shows the response for the full-time threshold.

Proposition 6. *Holding all else equal, the response of the utilization threshold to a change in aggregate productivity is given by:*

$$\frac{\partial \epsilon_F}{\partial z} = \frac{-(r+\lambda_P)(\tau_F + b + \frac{\alpha}{1-\alpha}\kappa(\theta - z\frac{\partial \theta}{\partial z}))}{z^2((r+\lambda_P)Y_F - (r+\lambda_F)Y_P - \lambda_F(Y_F - Y_P)(1-F(\epsilon_F)))} - \frac{Y_P(r+\lambda_F F(\epsilon_P))}{(r+\lambda_P)Y_F - (r+\lambda_F)Y_P - \lambda_F(Y_F - Y_P)(1-F(\epsilon_F))}\frac{\partial \epsilon_P}{\partial z} \tag{4.21}$$

when $\lambda_P = \lambda_F$,

$$\frac{\partial \epsilon_F}{\partial z} = -\frac{\tau_F - \tau_P}{z^2(Y_F - Y_P)}. \tag{4.22}$$

It is worth noting that the first expression in this proposition can not always be signed. The first term shows that as the cost of full-time employment increases. This threshold becomes more countercyclical (equivalently, the measure of shocks that result in full-time employment becomes more procyclical). The second term shows the interaction between the responses of part and full-time employment. If an aggregate shock makes part-time employment more lucrative (ϵ_P decreases by more), the impact on full-time employment is muted. Workers and firms would prefer more matches to end in part-time employment, limiting the scope of the effect on full-time employment.

When we impose that $\lambda_P = \lambda_F$ this threshold is clearly countercyclical. It is also clear that costs drive this cyclicality. On the other hand, if $\tau_F - \tau_P < Y_F - Y_P$ an increase in τ_F and Y_F, that leaves net output unchanged, will increase the countercyclicality of this threshold.

Like the utilization threshold, the separation threshold depends on costs and the response of full-time employment. We show the corresponding response in the following proposition.

Proposition 7. *Holding all else equal, the response of the separation threshold to a change in aggregate productivity is given by*

$$\frac{\partial \epsilon_P}{\partial z} = \frac{-\tau_P - b - \frac{\alpha}{1-\alpha}\kappa(\theta - z\frac{\partial \theta}{\partial z})}{Y_P(r+\lambda_P F(\epsilon_P))} + \frac{\lambda_P(Y_F - Y_P)(1-F(\epsilon_F))}{Y_P(r+\lambda_P F(\epsilon_P))}\frac{\partial \epsilon_F}{\partial z} \tag{4.23}$$

when $Y_F = Y_P$,

$$\frac{\partial \epsilon_P}{\partial z} = \frac{-\tau_P - b - \frac{\alpha}{1-\alpha}\kappa(\theta - z\frac{\partial \theta}{\partial z})}{Y_P(r+\lambda_P F(\epsilon_P))}. \tag{4.24}$$

This comparative static yields similar insights as the previous one. Let is now focus one second equation in this proposition. When part and full-time employment yield the same output (i.e., there is only one type of employment), changes in costs amplify the countercyclicality of this threshold, a point noted by Pissarides (2009).

Now we explore what conditions on these thresholds are required for our model to be consistent with our findings in Section 3. We start with the ratio of flows into unemployment.

Proposition 8. *The ratio of flows to unemployment is acyclical so that*

$$\frac{\partial \frac{PT \to U}{FT \to U}}{\partial z} = 0. \tag{4.25}$$

Because the separation thresholds are identical for part and full-time employment, this ratio is acyclical. It is worth noting that when we depart from a steady-state analysis, the previous will no longer hold. Even though it will remain close to acyclical. Next, we turn to flows out of unemployment and flows between part and full-time employment.

Proposition 9. *The cyclicality of the ratio of flows from unemployment to full-time relative to flows from unemployment to part-time is given by:*

$$\frac{\partial \frac{U \to FT}{U \to PT}}{\partial z} = -\frac{[(1-F(\epsilon_P))f(\epsilon_F)\frac{\partial \epsilon_F}{\partial z} - (1-F(\epsilon_F))f(\epsilon_P)\frac{\partial \epsilon_P}{\partial z}]}{[F(\epsilon_F) - F(\epsilon_P)]^2} \tag{4.26}$$

and this ratio is procyclical if the following condition is satisfied:

$$(1-F(\epsilon_P))f(\epsilon_F)\frac{\partial \epsilon_F}{\partial z} \leq (1-F(\epsilon_F))f(\epsilon_P)\frac{\partial \epsilon_P}{\partial z}. \tag{4.27}$$

If flows from full to part-time employment are countercyclical $\left(f(\epsilon_F)\frac{\partial \epsilon_F}{\partial z} \leq f(\epsilon_P)\frac{\partial \epsilon_P}{\partial z}\right)$, this requires that the measure of shocks that yield employment $(1-F(\epsilon_P))$ to be large enough relative to shocks that yield full-time employment $(1-F(\epsilon_F))$ not to reverse this type cyclicality.

Finally, we explore the properties of flows between part and full-time employment over the business cycle, which is given by Equation 4.19. This is identical to the ratio of flows out of unemployment, scaled by the frequency of shocks.

Proposition 10. *The cyclicality of the ratio of flows between part and full-time employment is given by:*

$$\frac{\partial \frac{PT \to FT}{FT \to PT}}{\partial z} = -\frac{\lambda_P[(1-F(\epsilon_P))f(\epsilon_F)\frac{\partial \epsilon_F}{\partial z} - (1-F(\epsilon_F))f(\epsilon_P)\frac{\partial \epsilon_P}{\partial z}]}{\lambda_F[F(\epsilon_F) - F(\epsilon_P)]^2} \tag{4.28}$$

and this flow ratio is procyclical if the following condition is satisfied

$$(1-F(\epsilon_P))f(\epsilon_F)\frac{\partial \epsilon_F}{\partial z} \leq (1-F(\epsilon_F))f(\epsilon_P)\frac{\partial \epsilon_P}{\partial z}. \tag{4.29}$$

This finding is simply scaling the flows out of unemployment by $\frac{\lambda_P}{\lambda_F}$. This reflects the close to fixed multiple between these ratios that we observed in Section 3.

To be able to determine the procyclicality of the ratio of flows from unemployment to full-time relative to flows from unemployment to part-time, we need to determine how the different endogenous employment thresholds respond. Figure 4.2 depicts the impact of an aggregate shock to the steady-state employment thresholds.

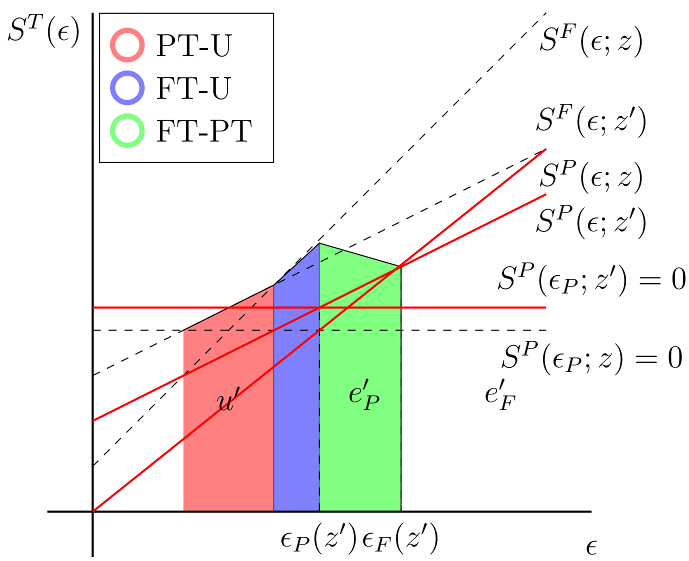


Figure 4.2: Response to Aggregate Shocks

As we can see, the model's prediction can be consistent with Proposition 9. Findings in Section 3 suggest that flow from full-time employment to part-time employment is pro-cyclical. This type of flow is mainly observed among workers staying within the same firm. Similarly, flows from part-time employment to full-time employment is counter-cyclical, and is also found primarily with workers staying within the same firm.

4.6 Acyclical Costs and Employment

An important aspect of our economic environment is that employers face differential acyclical fixed costs that differ by worker utilization. This model feature reflects the fact that part and full-time employment are critically shaped by legislation, resulting in different costs and legal requirements.[18] Next we analyze how changes in these costs affect the endogenous employment thresholds. We first start with the full-time threshold.

Proposition 11. *The effect of a change in full-time costs on the part/full separation threshold*

[18]For instance, in the U.S., full-time jobs often offer paid time-off and employer-sponsored retirement programs. Moreover, employing firms are required to provide health insurance to workers. These features are not present in part-time employment arrangements.

is given by:

$$\frac{\partial \epsilon_F}{\partial \tau_F} = \frac{(r+\lambda_P)(r+\lambda_F)[(r+\lambda_P)+(\lambda_P-\lambda_F)\kappa\frac{\alpha}{1-\alpha}\frac{\partial\theta}{\partial\tau_F}] - (r^2-\lambda_P\lambda_F)(\lambda_P-\lambda_F)[1-F(\epsilon_P)]\frac{\partial\epsilon_P}{\partial\tau_F}}{((r+\lambda_P)Y_F-(r+\lambda_F)Y_P)(r+\lambda_P)(r+\lambda_F)-(r^2-\lambda_P\lambda_F)(\lambda_P-\lambda_F)[1-F(\epsilon_F)](Y_P-Y_F)} \tag{4.30}$$

and when $\lambda_F = \lambda_P$,

$$\frac{\partial \epsilon_F}{\partial \tau_F} = \frac{1}{z(Y_F - Y_P)}. \tag{4.31}$$

Like our findings for aggregate productivity in Section 4.5, the utilization threshold responds in two distinct ways to changes in costs. First, the threshold increases because full-time matches produce less surplus. Note, however, that the second term is ambiguous. The threshold may decrease because the value of part-time employment is partially dependent on the possibility that a worker may eventually transition to full-time work. However, it may also amplify the impact if part-time employment is profitable on its own. The key takeaway is that as the value of full-time work declines, it has a reverberating effect on part-time employment. Next, we consider how the part-time threshold responds to changes in costs.

Proposition 12. *The effect of a change in part-time costs on the employment/unemployment separation threshold is given by:*

$$\frac{\partial \epsilon_P}{\partial \tau_P} = \frac{r+\lambda_P}{(r+F(\epsilon_P))zY_P} + \frac{\lambda_P}{r+F(\epsilon_P)}[1-F(\epsilon_F)](\frac{Y_F}{Y_P}-1)\frac{\partial \epsilon_F}{\partial \tau_P}. \tag{4.32}$$

As before, this expression varies with the response of the full-time threshold to part-time costs. If the expected surplus of full-time employment declines, the utilization threshold may increase as well, exacerbating the effects. If the surplus is largely unaffected, firms may shift workers to full-time work.

5 Model Parametrization and Quantitative Results

In this section we discuss taking our model to the data. To do so, first we use functional forms and a subset of parameters values commonly accepted in the search literature. After external calibration of some parameter values, we use simulated method of moments by matching implied steady-state flows generated by the model.

From now on, we approximate our model in discrete time at a weekly frequency, with discount factor $\beta = \frac{1}{1+r}$, and allow for aggregate productivity, z, to evolve in response to shocks.

5.1 External Calibration

In terms of functional forms, we make the common assumption that the matching function is Cobb-Douglas, $M(u, v) = Au^{\eta}v^{1-\eta}$, where η is the elasticity parameter, and A the efficiency parameter. We further assume that idiosyncratic productivity is described by $\epsilon \sim LN(\mu_{\epsilon}, \sigma_{\epsilon})$, and the evolution of aggregate productivity is given by $ln(z_{t+1}) = \rho_Z ln(z_t) + \nu$, where $\nu \sim N(0, \sigma_z)$. Throughout the rest of our quantitative analysis, we approximate the dynamics of the aggregate shock using the method described in Tauchen (1986).

Given our functional forms, we follow the literature and externally calibrate a subset of our parameters. We set the matching function elasticity to $\eta = 0.72$, following Shimer (2005), who estimates this parameter directly from the data. We also make the common assumption that the Hosios Condition holds. As a result, the bargaining power of a worker equals the elasticity of the matching function with respect to unemployment; i.e, $\alpha = \eta = 0.72$. We normalize output of a part-time job to be $Y_P = 1$, so that all parameters are relative to part-time output. We follow Fujita and Ramey (2012) and set vacancy creation cost, κ, the productivity cost of 6.7 hours of work. We assume the work is part-time and which yields $\kappa = 0.2939$ by taking 6.7 hours divided by an average of 22.8 hours per week for part-time work in our sample. The appropriate value for unemployment utility is contentious, ranging from 0.4 estimated by Shimer (2005) to 0.955, estimated by Hagedorn and Manovskii (2008), and has important implications for labor market fluctuations in search models (Hagedorn and Manovskii, 2008). We follow Mortensen and Nagypal (2007) and set unemployment utility to $b = 0.7$. This is conservative in our model because b is typically targeted as a fraction of average productivity, which in our model exceeds 1. However, a high b results in little or no part-time employment. As a result, we target 70% of part-time output. We consider an annual interest rate of 4%, which yields a weekly interest rate of $r = 0.0012$. This results in a discrete discount factor, $\beta = \frac{1}{1+r}$, of 0.9992. For parameters describing the aggregate productivity process, we follow Hagedorn and Manovskii (2008), who estimate an AR(1) productivity process in a search model yielding $\rho_Z = 0.9895$ and $\sigma_Z = 0.0034$.

After implementing this parametrization, we are left with 8 parameters to estimate: Y_F, τ_F, τ_P, λ_F, λ_P, σ_{ϵ}, and A. We choose to calibrate these parameters internally rather than externally because they are either novel $(Y_F, Y_P, \tau_F, \tau_P, \lambda_F, \lambda_P)$, affect the endogenous productivity process (σ_{ϵ}), or are a normalization (A). We first impose the restriction on the arrival rate of idiosyncratic shocks implied by Equation 4.18, $\frac{PT-U}{FT-U} = \frac{\lambda_P}{\lambda_F}$. In our data, the average arrival rates for $PT - U$ and $FT - U$ are 0.546 and 0.0087, respectively. Such values imply $\lambda_P = 6.23\lambda_F$.

5.2 Simulated Methods of Moments

To determine the 6 remaining parameters we use the simulated method of moments procedure. In particular, we target steady state flows between full-time, part-time, and unemployment as well as steady-state rates of part and full-time employment to discipline the value of the remaining parameters. To do so, we estimate these series at a monthly frequency in the CPS between 1996 and 2019, using the same sample restrictions that we described in Section 3.

Although our parameters are jointly estimated and therefore their sources of identification are difficult to pin down explicitly, we can outline the moments most closely associated with each parameter. The cost and productivity parameters Y_F, τ_F, τ_P determine the relative net output of part and full-time work, and therefore primarily adjust employment levels. The arrival rate of match-specific shocks for full-time work, λ_F, determines the frequency with which a full-time worker may transition to part-time or unemployment, and σ_ϵ determines the probability of such a transition, and therefore are primarily identified by flows out of full and part-time employment. The final parameter, A, proportionally changes the job-finding rate, and as a result can be primarily associated with flows out of unemployment. The underlying parameter values are reported in Table 1.

Parameter	Value	Comment
Y_F	5.51	Full-time prod.
Y_P	1.00	Part-time prod. (normalized)
τ_P	0.1602	Part-time cost
τ_F	4.24	Full-time cost
λ_F	0.0218	Rate of full-time ϵ shocks
λ_P	0.1363	Rate of part-time ϵ shocks (fixed to 6.23 times λ_F)
σ_ϵ	0.1717	SD of ϵ shocks
A	0.1557	Matching efficiency
b	0.7	Unemp. utility (Fujita and Ramey, 2012)
η	0.7	Matching elasticity (Fujita and Ramey, 2012)
α	0.7	Hosios condition
β	0.9992	Annual discount rate of
κ	0.17	Vacancy creation cost (Fujita and Ramey, 2012)
ρ_Z	0.9895	Agg. shock persistence (Hagedorn and Manovskii, 2008)
σ_Z	0.0034	SD of agg. shocks (Hagedorn and Manovskii, 2008)

Table 1: Parameter Values.

5.3 Targeted Moments

After we assign parameter values according to the previous procedure, we find that the benchmark model is able to closely match all of the estimated targets. These are reported in Table 2.

As we can see, our model narrowly undershoots the job-finding rate of part-time work (0.0858 in the data versus 0.0807 in the model). As a result, the model overshoots the job-finding rate of full-time work (0.2086 in the data versus 0.2134 in the model). Nevertheless, both of these

Moment	Data	Model
Full-Time Emp.	0.9059	0.9031
Part-Time Emp.	0.0567	0.0592
$U \to FT$	0.2086	0.2134
$U \to PT$	0.0856	0.0807
$FT \to PT$	0.0211	0.0224
$PT \to FT$	0.3399	0.3389
$FT \to U$	0.0087	0.0088
$PT \to U$	0.0546	0.0537

Table 2: Estimation results.

equilibrium outcomes are still close to their data counterparts. The remaining moments are within fractions of a percent. We achieve this fit with parameter values that closely align with the results from previous papers.[19]

5.4 Non-Targeted Moments

In order to assess the performance of our benchmark parametrization, we now compare our model predictions of non-targeted moments generated by the model with the corresponding data counterparts. In particular, we first compare whether our model can produce similar levels of cyclicality among employment stocks and flows as in the data. Then, we compare our model's predictions about employment stocks and flows between 1996 and 2020 to the data using an estimated productivity series.

To do this comparison, we simulate the model with 1000 random series of productivity draws. For each of the 1000 simulations, we calculate the covariance between labor productivity and part and full-time employment as well as each flow between labor market states, part-time, full-time, and unemployed.[20] We present our findings in Table 3.

	FT Emp.		PT Emp		FT→PT		PT→FT		FT→U		PT→U		U→FT		U→PT	
Lag	Model	Data	Model	Data	Model	Data	Model	Data	Model	Data	Model	Data	Model	Data	Model	Data
-1	0.45	0.72	-0.47	-0.70	-0.47	-0.55	-0.35	-0.23	0.46	0.49	-0.08	0.30	-0.22	-0.51	0.10	0.19
0	0.94	0.84	-0.91	-0.80	-0.96	-0.55	-0.70	-0.18	0.96	0.58	-0.12	0.43	-0.42	-0.52	0.23	0.19
+1	0.61	0.89	-0.26	-0.81	-0.65	-0.48	-0.27	-0.10	0.65	0.68	-0.08	0.46	-0.00	-0.50	0.06	0.23

Table 3: Non-targeted moments.

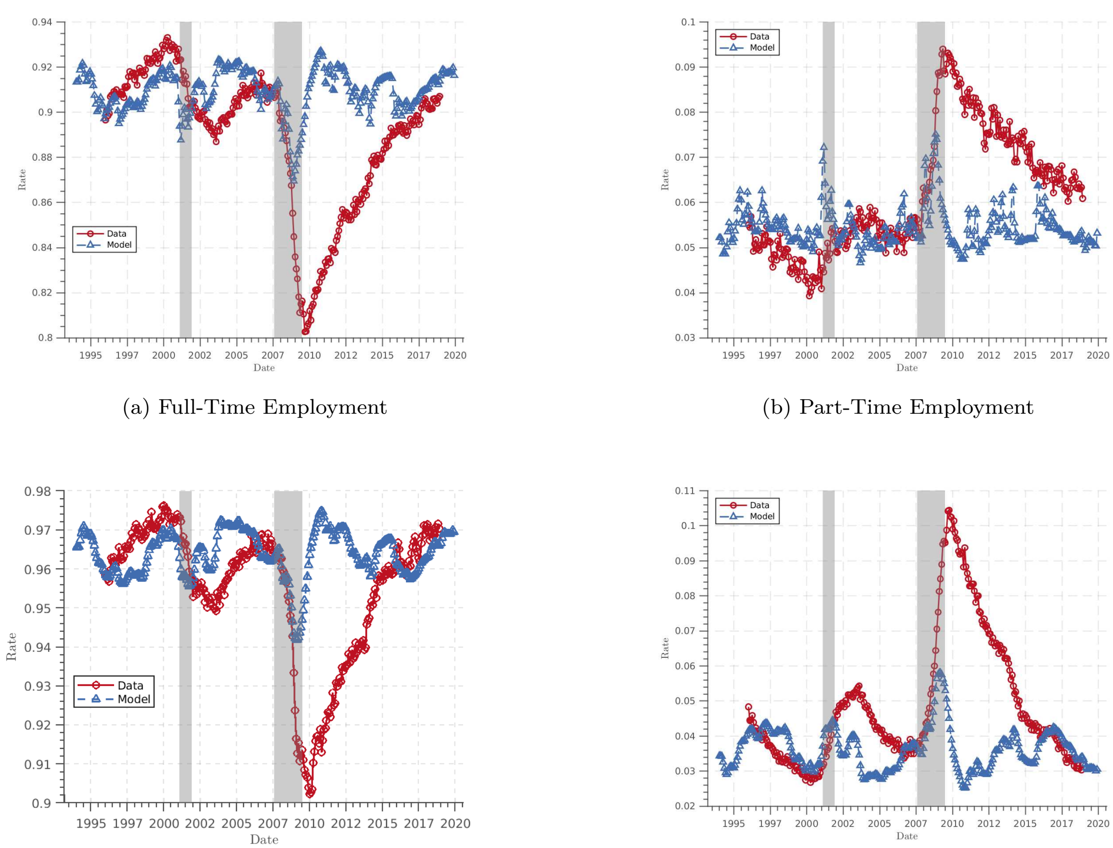
This shows that the benchmark model is able to replicate the cyclicality of the majority of series. The model anomaly is that it predicts a weakly negative separation rate of part-time jobs, where the data predicts a positive rate. However, the model matches the cyclicality of

[19] Our best fit yields a standard deviation of idiosyncratic shocks (σ_ϵ) of 0.172 and a matching scale parameter (A) of 0.156, both slightly higher than their estimates in Fujita and Ramey (2012), 0.16 and 0.094. We find that shocks arrive for full-time workers with probability $\lambda_F = 0.0218$ each week, which corresponds to $\lambda_P = 0.1363$ (6.23 times λ_F). We estimate that acyclical costs constitute about 13.5% of part-time output ($\tau_P = 0.1602$ with Y_P normalized to 1) and 77.0% of full-time output ($\tau_F = 4.24$ and $Y_F = 5.51$).

[20] We measure this as output/hours. In our model simulations, we set full and part-time hours to their averages between 1996 and 2020, 46 and 22.8 hours respectively.

part and full-time employment, despite slightly overstating the cyclicality of the flows between part and full-time employment. It also does a reasonable job matching the cyclicality with a one quarter lead or lag.

To further determine the performance of our framework, we simulate the model to the data between 1996 and 2020. To do this, we first estimate a sequence of aggregate shocks $Z_1, ..., Z_T$ by targeting quarterly labor productivity in the data. We do this because productivity in our model is endogenous. This is the case as both part and full-time work have different base levels of productivity and because separation thresholds vary over time. We then feed this series into the model and compare our results with the corresponding data counterparts. These different series are depicted in Figure 5.1. The top two figures plot full and part-time employment in the left and right panes, respectively. The bottom two figures display the aggregate employment rate and the unemployment rate. In each figure, the dashed blue line with triangle markers denotes the simulated data, while the red line with circle markers corresponds to the observed data.



(a) Full-Time Employment

(b) Part-Time Employment

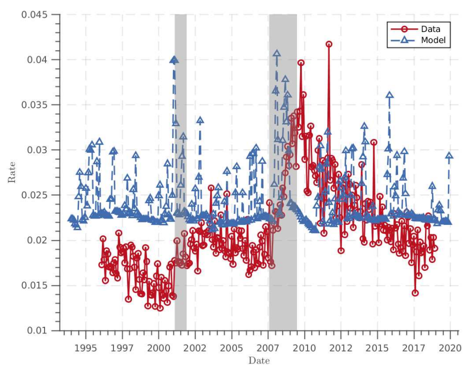
(c) Employment Rate

(d) Unemployment Rate

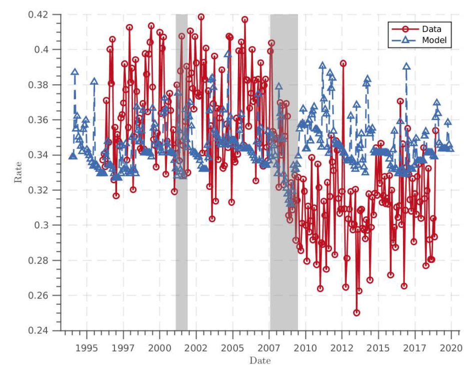
Figure 5.1: Comparison between observed and model generated employment.

Again, these figures show that our model does a good job replicating the cyclicality of each series. In particular, we find that both full-time employment and aggregate employment are procyclical, while it predicts that both part-time employment and unemployment are countercyclical. This is precisely what is observed in the data in Section 3. While the model does a reasonable job matching the data for most years, the model does not generate fluctuations of the same magnitude during the Great Recession. This suggests that in addition to the mechanisms in the presented in the model, there are other forces at play, such as demand-side fluctuations.[21]

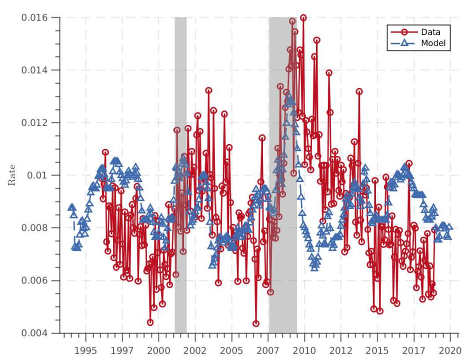
The model is able to replicate the flows observed in the data. In the top two panels of Figure 5.2, we plot the flows from full-time to part-time (left) and part-time to full-time (right). In the bottom two panels, we plot the flows from full-time to unemployment and part-time to unemployment.



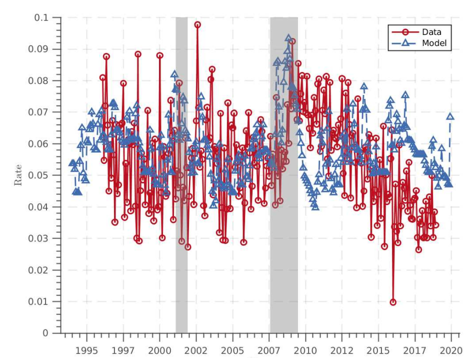
(a) Full-time to part-time



(b) Part-time to full-time



(c) Full-time to unemployment.



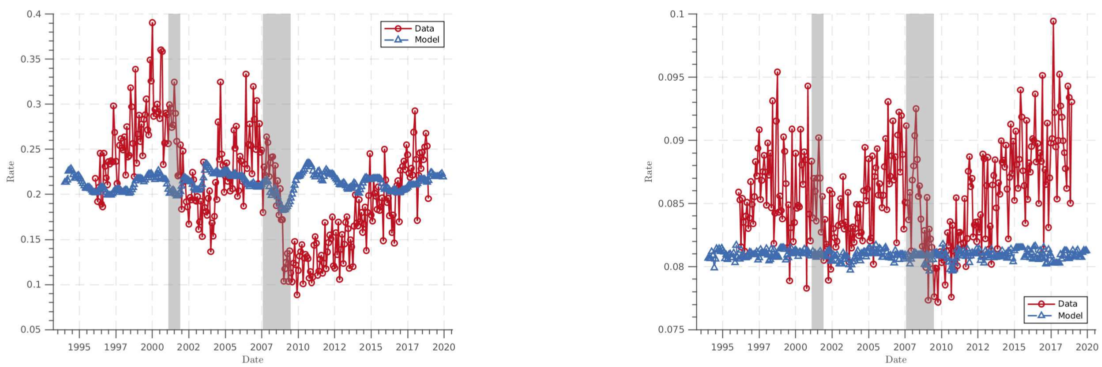
(d) Part-time to unemployment

Figure 5.2: Observed and model generated employment flows.

Although the model accounts for a large share of the volatility of each series, it doesn't quite capture the persistent increase in either the rate of workers flowing from full-time to part-time or the rate of workers flowing from full-time to unemployment.

[21] We refer to (Warren, 2015) for more on this.

The reason for the apparent inconsistency between the ability of our model to match flows out of part and full-time employment and its inability to replicate the stock of employed workers in Figure 5.1 is due to a well-known puzzle in the search and matching literature emphasized by (Shimer, 2005). The model does not replicate the degree of volatility in the job-finding rate that we observe in the data . We plot the job-finding rate of unemployed workers for full-time jobs (left panel) and part-time jobs (right panel) in Figure 5.3.



(a) Unemployment to full-time.

(b) Unemployment to part-time.

Figure 5.3: Observed and model generated employment flows.

While the model does better at capturing fluctuations in the full-time job-finding rate, it predicts negligible fluctuations in the part-time job-finding rate. As pointed out by Shimer (2005), Hagedorn and Manovskii (2008), and Hall and Milgrom (2008), among many others, this occurs because the bulk of the fluctuations in productivity are reflected by changes in wages.

6 Exploring the Mechanisms

6.1 The Cyclicality of Part and Full-Time Employment

Before delving into the sources of cyclicality in the model, we explore the mechanisms that result in the dynamics of the model. First, we explore how the utilization and separation threshold, ϵ_F and ϵ_P, respectively, fluctuate in response to aggregate shocks. Second, we describe how the endogenous distribution of match quality evolves over the business cycle. Last, we show how aggregate shocks affect vacancy creation and as a consequence, market tightness and the job-finding rate. Each of these mechanisms is an equilibrium object that responds to aggregate shocks and determines flows in the labor market.

There are 6 flows as well as an equilibrium distribution of match quality that respond to each mechanism. We first define a function G that denotes the distribution of match quality. We also define distribution functions G^F and G^P that track the distribution of full and part-time work for convenience. The evolution of these three distributions are given by:

$$\dot{G^F}(x) = (\lambda_P e^P + \lambda_F e^F + P(\theta)u)[F(x) - F(\epsilon_P)] + \int_{\epsilon_P}^{x} g(x)dF(x) - G(x) \tag{6.1}$$

$$\dot{G^P}(x) = (\lambda_P e^P + \lambda_F e^F + P(\theta)u)[F(x) - F(\epsilon_P)] + \int_{\epsilon_P}^{x} g(x)dF(x) - G(x) \tag{6.2}$$

$$\dot{G}(x) = \dot{G^P}(x) + \dot{G^F}(x) \tag{6.3}$$

The flows in the stochastic version of the model are largely similar to the steady-state version that we introduced in Section 4, but now include the endogenous response of the match quality distribution to aggregate shocks. Flows between part and full-time work respond to idiosyncratic shocks as well as the evolution of the distribution of match quality, as do flows into unemployment:

$$\frac{e^F \to e^P}{e^F} = \lambda_F[F(\epsilon_F) - F(\epsilon_P)] + \gamma[G(\epsilon_F) - G(\tilde{\epsilon_F})] \tag{6.4}$$

$$\frac{e^P \to e^F}{e^P} = \lambda_P[1 - F(\epsilon_F)] + \gamma[G(\tilde{\epsilon_F}) - G(\epsilon_F)] + \gamma[G(\epsilon_P) - G(\tilde{\epsilon_P})] \tag{6.5}$$

$$\frac{e^F \to u}{e^F} = \lambda_F F(\epsilon_P) + \gamma G(\epsilon_P) \tag{6.6}$$

$$\frac{e^P \to u}{e^P} = \lambda_P F(\epsilon_P) + \gamma G(\epsilon_{P)}. \tag{6.7}$$

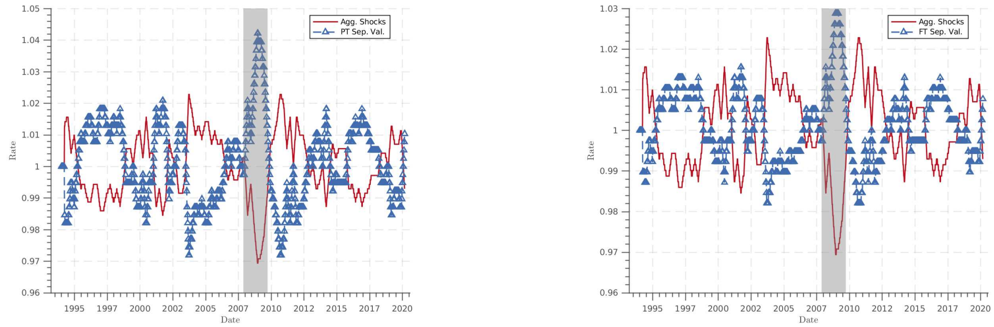
where $\tilde{\epsilon_P}$ and $\tilde{\epsilon_F}$ denote the utilization and separation thresholds for the previous level of aggregate productivity. The final two flows, those out of unemployment, and are determined by both changes in the utilization and separation thresholds and the response of vacancy creation to aggregate shocks.

$$\frac{u \to e^F}{u} = p(\theta)[1 - F(\epsilon_F)] \tag{6.8}$$

$$\frac{u \to e^P}{u} = p(\theta)[F(\epsilon_F) - F(\epsilon_P)]. \tag{6.9}$$

As they appear in each flow, understanding the fluctuation of thresholds is key for understanding the flows in the model. To do this, we plot the utilization and separation thresholds along with the aggregate shock, normalized to their values prior to the Great Recession in Figure 6.1. The left panel plots the separation threshold, ϵ_P, as a dashed blue line with triangle markers and aggregate productivity as a solid red line. The right panel plots the utilization threshold, ϵ_F, as a dashed blue line with triangle markers and aggregate productivity as a solid red line. We normalize each series 1 in the initial period.

These plots show a key mechanism in the model. The part-time separation threshold is less



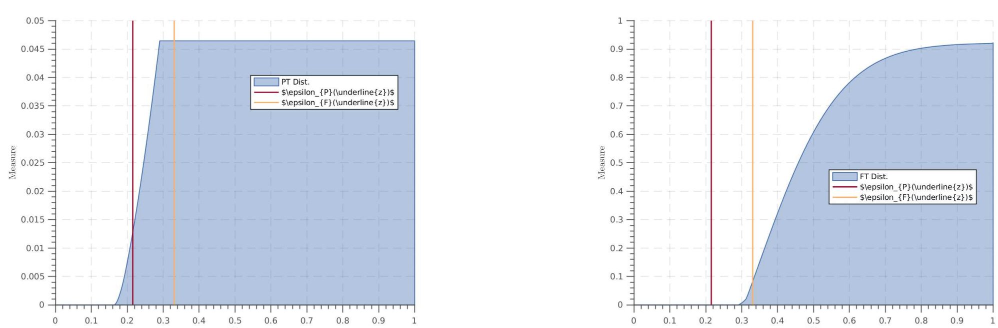
(a) Separation threshold.

(b) Utilization threshold.

Figure 6.1: Thresholds over time, plotted with aggregate productivity. Normalized to 1.

cyclical than the full-time separation threshold, yielding one reason why full-time employment is procyclical and part-time employment is countercyclical.

Next, we show how the endogenous distribution of match quality evolves over the business cycle. Both flows between part and full-time employment and into unemployment respond to the evolution of the distribution of match quality. In turn, the distribution of match quality evolves as aggregate shocks affect the utilization and separation thresholds. To see how this distribution changes over the business cycle, we consider the distribution at two moments in time. First, we plot the un-normalized CDF of part-time employment across the domain of idiosyncratic productivity (normalized to lie between 0 and 1). We include on this plot two lines that denote the separation threshold (red line) and utilization threshold (yellow line) at the bottom of the trough of the Great Recession. We repeat this for full-time employment and plot our results in Figure 6.2, with part-time employment on the left and full-time employment on the right.

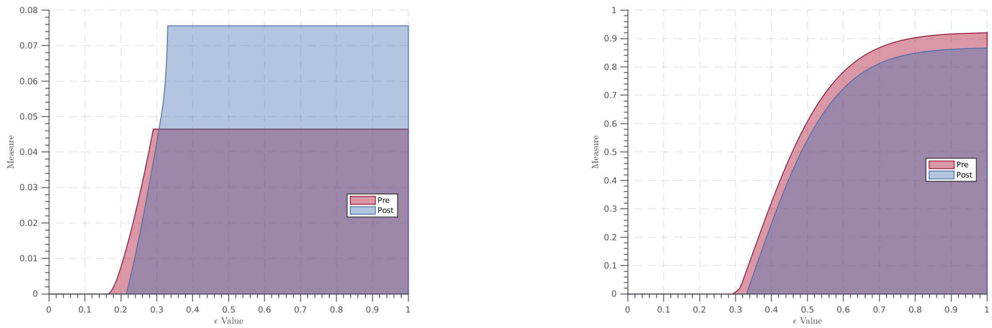


(a) Part-time match quality distribution.

(b) Full-time match quality distribution.

Figure 6.2: Match quality cumulative distributions at the peak prior to the Great Recession.

To see how this affects the distributions of match quality, we compare the match quality distributions at the peak and trough of the Great Recession. We do this by overlaying the distribution of the trough on the peak distribution for part and full-time employment and plot our results in Figure 6.3. The left figure plots the part-time distribution and the right panel plots the full-time distribution. In both, the peak distribution is in blue, while the trough distribution is in red.



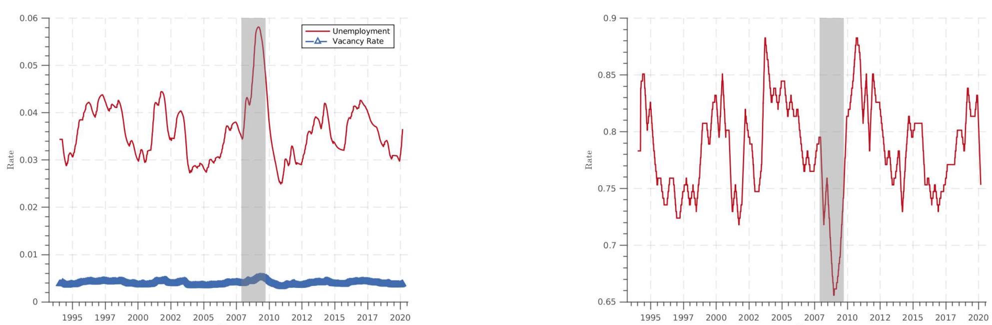
(a) Part-time match quality distribution.

(b) Full-time match quality distribution.

Figure 6.3: Match quality cumulative distributions at the peak prior to the Great Recession.

While the difference between the distributions is small, it has a sizable effect on employment, as we show in Section 6.1.1.

Last, we explore the evolution of vacancy creation over the Great Recession in our model. From Equation 6.8 and Equation 6.9, we can see that vacancy creation is key for job-finding rates. To see how this changes over the business cycle, we plot the vacancy rate and the unemployment rate as well as the expected surplus of a match during the Great Recession in Figure 6.4 shows our results. In the left panel, we separately plot the vacancy rate (blue dashed line) and the unemployment rate (red solid line), the ratio of which is labor market tightness, to show the source of fluctuations in the job-finding rate. In the right panel, we plot the expected surplus, a constant fraction $1 - \alpha$ of which is the value of opening a vacancy to an unmatched firm.



(a) Vacancy and unemployment rates.

(b) Expected surplus of a match.

Figure 6.4: Determinants of vacancy creation and the job-finding rate.

This shows that vacancy creation is procyclical and driven by fluctuations in the surplus.

6.1.1 The Source of Cyclicality

Now, we turn to understanding what drives the procyclicality of full-time work and the countercyclicality of part-time work in the model. In Section 5.4, we showed that the model is capable of matching the degree of cyclicality in nearly all flows in the labor market, though it does not match the magnitudes of the fluctuations. Here, we consider three experiments to understand how the mechanisms described in Section 6.1 contribute to the cyclicality of the model.

First, we restrict the separation and utilization thresholds for matches that receive an idiosyncratic shock during the period and job-finding rates for all matches to their steady-state level. To do this, we allow these thresholds to remain at their steady state levels, i.e., $\epsilon_P = \epsilon_P(\bar{z})$ and $\epsilon_F = \epsilon_F(\bar{z})$ for any jobs that did not receive an idiosyncratic shock. The degree of cyclicality produced by this experiment is caused by the fluctuation in thresholds and the arrival of idiosyncratic shocks. When we present our findings in Table 4, we call this restriction "Only $F(\epsilon_P), F(\epsilon_F)$."

Second, we restrict the flow of idiosyncratic shocks to be zero ($\lambda_P,\ \lambda_F = 0$) and set the job-finding rate to its steady-state value, $p(\theta) = p(\theta(\bar{z}))$. This makes initial match quality fixed within a match and means that jobs separate or change utilization only in response to fluctuations in the thresholds. As a result, the remaining cyclicality is caused by the interaction between the two thresholds and the match quality distribution. In Table 4 we call this restriction "Only $G(\epsilon_P), G(\epsilon_F)$."

Last, we set the separation thresholds to their steady-state values and set the arrival rate of idiosyncratic shocks to zero. This shows the contribution to cyclicality of fluctuations in the job-finding rate. In Table 4 we call this restriction "Only θ."

To calculate the effect of each experiment on cyclicality, we calculate the contemporaneous correlation between our series of interest and aggregate productivity and compare it with the model and the data. We present our findings in Table 4.

Sim	FT Emp.	PT Emp	FT→PT	PT→FT	FT→U	PT→U	U→FT	U→PT
Data	0.84	-0.80	-0.55	-0.18	0.58	0.43	-0.52	0.19
Base	0.98	-0.85	-0.98	-0.66	0.99	-0.06	-0.36	0.20
Only $F(\epsilon_P),\ F(\epsilon_F)$	0.81	0.76	-0.99	0.19	0.99	-0.92	0.50	-0.55
Only $G(\epsilon_P),\ G(\epsilon_F)$	0.98	-0.87	-0.97	-0.67	0.99	-0.90	-0.38	0.21
Only θ	0.83	0.91	-0.00	-0.00	1.00	1.00	-0.00	-0.00

Table 4: Cyclicality of different counterfactual models.

While these experiments are not nested, and therefore we cannot directly decompose the degree of cyclicality caused by each source, we are clearly able to see which components drive the cyclicality of each series. When there are only idiosyncratic shocks ("Only $F(\epsilon_P), F(\epsilon_F)$"), the cyclicality of separations increases substantially, while part-time employment becomes procyclical. When cyclicality is determined exclusively by aggregate shocks to the match quality distribution ("Only $G(\epsilon_P), G(\epsilon_F)$"), the part-time to unemployment separation rate becomes far too countercyclical. Last, when only θ is allowed to vary away from its steady-state value, flows into unemployment become too procyclical, while job-finding rates become nearly acyclical. This is because while $p(\theta)$ rate may be procyclical, neither threshold adjusts and as a result mute the cyclicality.

As a final experiment, we consider how the cyclicality of the surplus drives our findings. We consider a simple alternatives: a model in which a fraction ω of each acyclical cost responds 1-to-1 with fluctuations in aggregate productivity. We set this fraction to $\omega = 0.5$ and present the results in Table 5.

Sim	FT Emp.	PT Emp	FT→PT	PT→FT	FT→U	PT→U	U→FT	U→PT
Data	0.84	-0.80	-0.55	-0.18	0.58	0.43	-0.52	0.19
Base	0.98	-0.87	-0.99	-0.72	0.99	0.08	-0.15	0.15
$\tau_F = \tau_F(z)$, $\tau_P = \tau_P(z)$	0.96	-0.54	-0.99	-0.66	1.00	0.92	-0.06	0.07

Table 5: Cyclicality when a 50% of the acylical costs are now cyclical.

While this counterfactual performs worse along some dimensions, like the cyclicality of part-time employment, it performs better along others, like the cyclicality of the flows from part-time to full-time. We see this as an indication that had we modeled costs as procyclical, the mechanisms in our model continue to explain an important fraction of the cyclicality.

6.2 The Importance of Part-Time Employment

In this section, we show that ignoring employment utilization has important implications for predictions about labor market fluctuations and the cost of downturns for workers.[22] We first demonstrate that a model that pools part and full-time employment together will both i) underpredict the size of the decline in employment during a recession and ii) understate the impact of a downturn on workers. Next, we simulate a counterfactual model without a utilization distinction that matches the same steady-state as our baseline model and show the differences in predictions during the Great Recession.

In models that derive from Mortensen and Pissarides (1994), steady-state employment is determined by the expected surplus and the separation threshold. These same quantities determine steady-state employment in our model. The differences in that part and full-time employment introduce a non-convexity in the surplus in our model. This means that given a match quality $\epsilon \in [\epsilon_P, \epsilon_F)$, workers in our model are more likely to separate than workers in equally productive matches in a model without part-time work when both models are subject to a negative aggregate shock. We plot the intuition for this result in Figure 6.5, by comparing

[22] This is important because only a handful of search models incorporate this dichotomy. Among them are Warren (2015), Borowczyk-Martins and Lalé (2020).

a hypothesized surplus function for our model with a model that lacks a utilization dichotomy. The dashed red line shows the surplus in our baseline model, while the dashed blue line shows the surplus in the hypothesized model without part-time employment. The solid red and blue lines show the response of the surplus to aggregate shocks for our model and the counterfactual model, respectively.

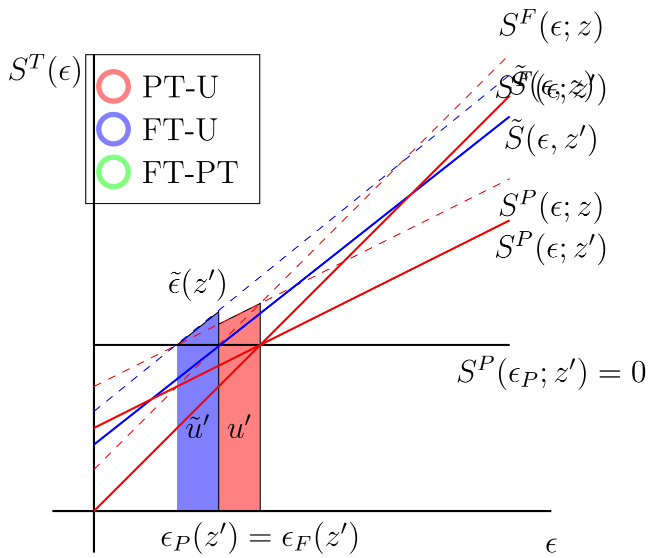
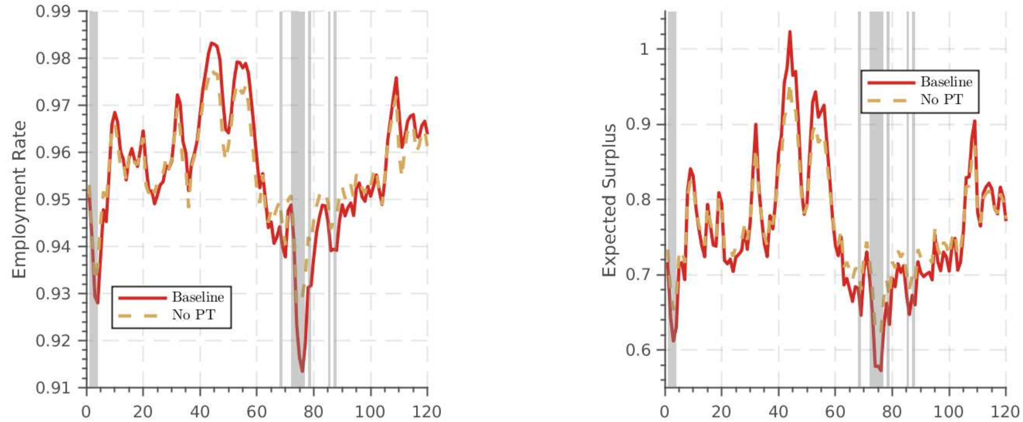


Figure 6.5: Response to aggregate shocks.

Intuitively, while both economies suffer a decline in aggregate productivity, the lower surplus among the part-time jobs causes a larger decline in employment. In the economy without a utilization dichotomy, unemployment increases by $\tilde{u}'$. In our economy, unemployment would increase by $\tilde{u}' + u'$. For further precision, we now calibrate a canonical search model and assess the degree of difference in predictions.

To determine the effects of removing the intensive margin, we estimate a counterfactual model in which there is no distinction between part and full-time employment. The model retains the same estimate of A as in the baseline model and we set the arrival rate of shocks λ to the population average in the baseline model, $\lambda = \lambda_P e^P + \lambda_F e^F$. The only distinction between our counterfactual and the Mortensen and Pissarides (1994) model is that we include an acyclical cost, τ, to keep rents procyclical so that our findings are comparable to our baseline model. We subject the models to the same series of aggregate shocks as in our Great Recession experiment and show how this compare to our baseline model in Figure 6.6. In the left panel, we compare the impact of aggregate shocks on employment in both economies. In the right panel, we compare the average surplus in both economies over this period. In both panels, the baseline economy is the solid red line and counterfactual economy is the dashed blue line.

What these figures make clear is that for the same set of aggregate shocks, the impact is



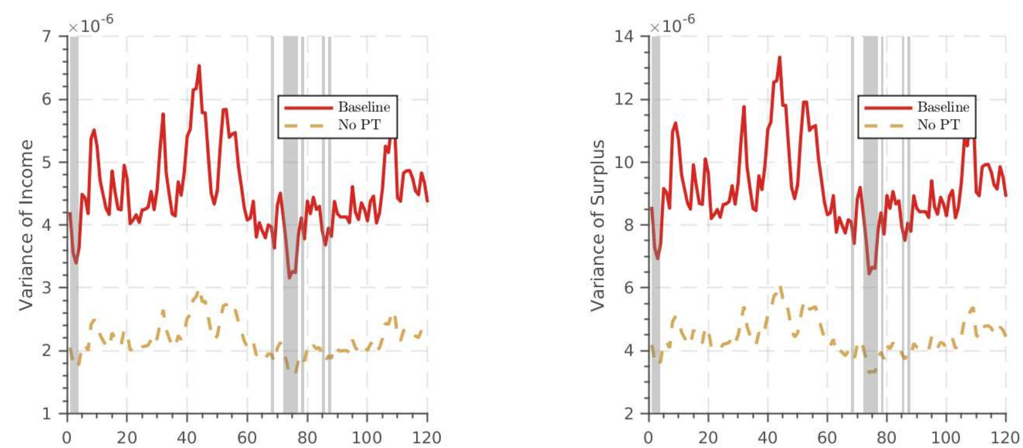
(a) Average employment.

(b) Expected surplus of a match.

Figure 6.6: Employment and job creation.

muted in the counterfactual economy. While the downturn is still sizable in the counterfactual economy, at the trough it remains 1.5 percentage points higher. The right panel shows that the counterfactual economy continues to understate the effect on the average surplus from a match.

This last finding provides suggestive evidence that the counterfactual economy may understate the impact on welfare and inequality. To see this, we place the variance in income in both economies (left panel) as well as the variance in the surplus (right panel) in Figure 6.7. Both calculations include unemployed workers, who receive identical incomes b and surplus $S(\epsilon_{P(z)}, z)$. As before, in both panels the baseline economy is plotted as a solid red line and the counterfactual economy is plotted as a dashed blue line.



(a) Variance of income.

(b) Variance of the surplus.

Figure 6.7: Inequality in both economies.

While these values appear small, it's worth noting that these are both weekly values averaged over a quarter. Given that our weekly wages are around 1 and average annual income in the United States is around \$35,000, these predicted differences become sizable at an annual frequency. Our baseline economy consistently predicts a variance of income more than double that of the economy without part-time utilization. In addition, because agents in our model are risk neutral, the effect on welfare is muted; in a model with risk averse agents, it is not difficult to conjecture that the variance in welfare could be much larger because of the higher degree of unemployment and the lower wages among part-time workers.

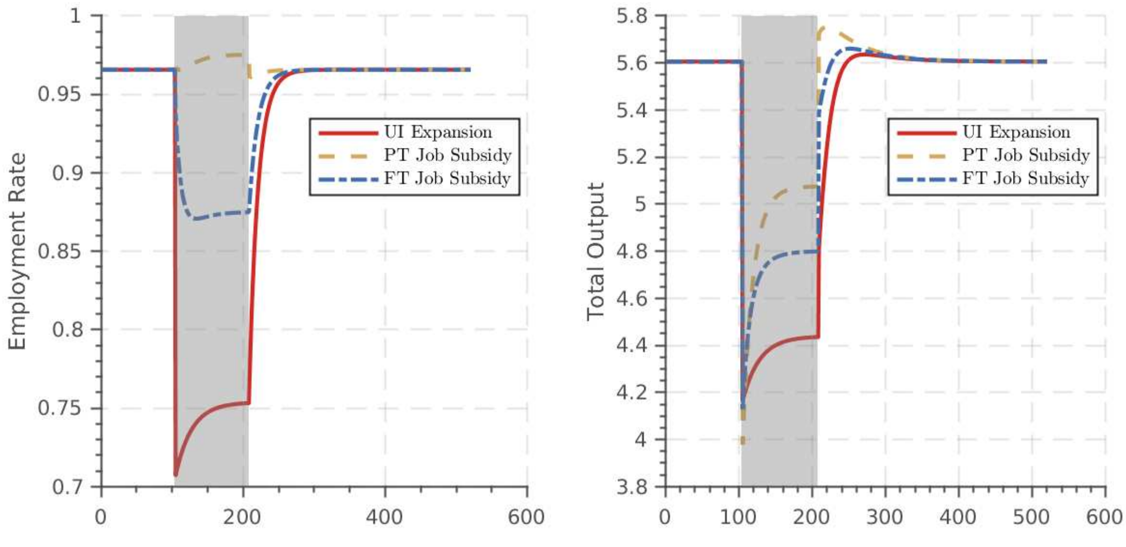
7 Policy Experiments

Our model presents a natural setting in which to consider the effectiveness of labor market policies at limiting the size and duration of downturns in the labor market. Because unemployment insurance (UI) is often extended during recessions (both the Great Recession and the Covid-19 Recession), we consider this our baseline policy that the government finances during a downturn. As an alternative, we consider an equally costly "job-subsidy," in which the government instead finances transfers to firms to retain employees. We compare the effect of these two policies on the labor market recovery as well as the decline in output that results from a recession.

To compare these policies during a downturn, we impose a 7% decline in aggregate productivity (the lower limit of our productivity grid) and then implement policies as follows. First, we institute a 20% increase in unemployment utility, b, which we assume is completely financed by the government. Then, we consider a job subsidy τ_T' (either part or full-time), where $\tau_T - \tau_T'$ is financed by the government. We impose that the cost of the job subsidy must equal the cost of the additional unemployment benefits. In each experiment, we assume that prior the economy is in the steady-state prior to the recession and that these policy changes are unanticipated. Once these policies are instituted, agents expect them to last for the duration of the recession. After 8 quarters, we assume that aggregate productivity returns to the steady-state and policies return to their baseline levels; agents no longer anticipate the previous policy regime. To achieve the same costs, τ_P fell from 0.1602 to -0.011 in the part-time job subsidy, while τ_F fell from 4.24 to 4.19.

Despite small changes in each acyclical cost, both job-subsidy economies recover more rapidly and suffer a smaller decline than the UI expansion economy. We first explore differences in aggregate outcomes in Figure 7.1. We start by comparing aggregate employment (left panel) and aggregate output (right panel) for the three policies. In each plot, the UI expansion is the solid red line, the part-time subsidy is the dashed yellow line, and the full-time subsidy is the dashed blue line.

The economy with the part-time subsidy endures both a smaller decline in employment and



(a) Employment

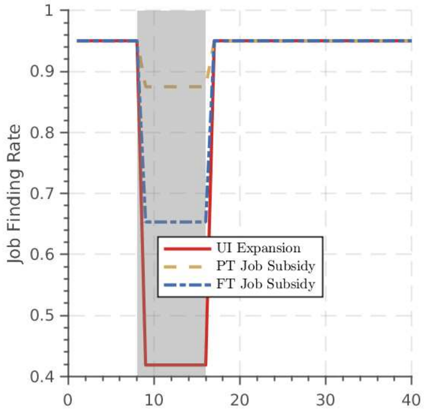
(b) Output

Figure 7.1: Determinants of vacancy creation and the job-finding rate.

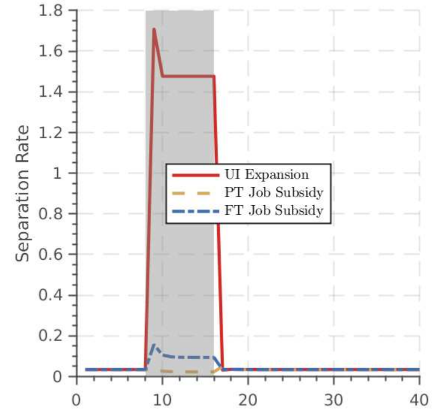
a smaller decline in output. In fact, there is nearly no decline in employment despite a drop in aggregate productivity of 7%. The full-time job subsidy also performs better than the UI expansion, although it results in a larger decline in employment and output than the part-time subsidy.

Next, we explore the reasons for the smaller decline in employment and output for the two job subsidies. In Figure 7.2, we show the job-finding rate (top left panel), the separation rate (top right panel), part-time employment (bottom left panel) and full-time employment (bottom right panel).

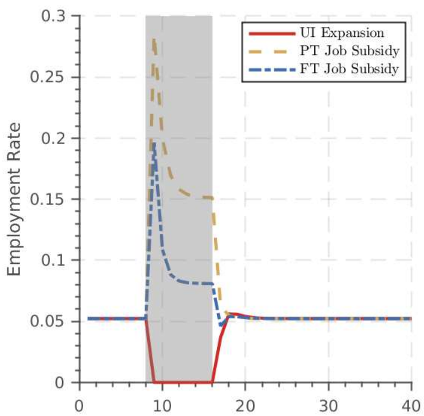
This figure yields insight into the reasons why part-time subsidies outperform the two alternative policies. In the part-time subsidy economy, there is still a decline in job-finding, indicating that the expected surplus of a match falls. However, there is only a marginal increase in the separation rate. Why is that the case? Because vacancy creation is costly and retaining a match provides more surplus than searching for a new one. In both the part and full-time subsidy economies, firms hoard workers at part-time utilization, while part-time falls to zero in the UI expansion economy.



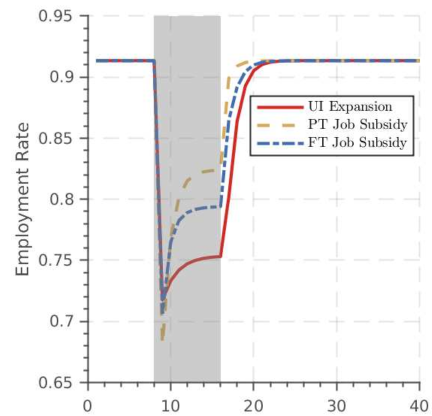
(a) Job-finding rate.



(b) Job separation rate.



(c) Part-time employment rate.



(d) Full-time employment rate.

Figure 7.2: Comparison between each policy experiment economy.

8 Conclusion

In this paper we propose a framework that can account for the cyclicality of part and full-time employment. We accomplish this by extending a canonical search model to include acyclical costs that, along with output, vary by part or full-time utilization. This allows firms another type of adjustment in response to shocks that alter aggregate productivity or match quality.

We show that adjustments in utilization in response to aggregate shocks play a key role in the cyclicality of part and full-time employment. Adjustment in separation and utilization both increase the procyclicality of part-time employment. However, the movement from full-time to part-time employment causes part-time employment to become countercyclical. We also show that models with a single extensive margin understate both the degree of employment fluctuations and the impact of those fluctuations on inequality.

We additionally show that part-time employment can be exploited by policy-makers to limit the size and duration of downturns in the labor market. We compare an expansion in unemployment insurance, a policy undertaken in each of the last three recessions, against a subsidy offered to firms that retain workers part-time. We find that the "job subsidy" strongly outperforms the expansion in unemployment insurance, despite holding costs fixed under both policies. Although this policy prevents low quality matches from separating, it also prevents a sizable loss of intangible capital caused by matching frictions. We view this as a strong endorsement of a job-subsidy scheme in response to future downturns.

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A Appendix

A.1 Proofs

Proof of Equation 4.15 and Equation 4.17

Proof. Both thresholds can be solved explicitly by operating on the surplus equation. Without loss of generality, we assume that $\epsilon_F \geq \epsilon_P$. Integrating by parts, the surplus in Equation 4.8 is generically expressed as follows:

$$\begin{aligned}(r+\lambda_T)\, S^T(\epsilon) = {} & z\epsilon Y_T - \tau_T - b - \frac{\alpha}{1-\alpha}\theta\kappa \\ & + \frac{z\lambda_T}{r+\lambda_T}\left[Y_F \int_{\epsilon_F}^{\bar{\epsilon}} [1-F(x)]\, dx + Y_P \int_{\epsilon_P}^{\epsilon_F} [1-F(x)]\, dx\right]. \end{aligned} \tag{A.1}$$

□