The Value of Contingent Work

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Abstract

What is the optimal unemployment insurance (UI) policy in the presence of contingent work? First, I document new facts about contingent work: there are large changes in firms' contingent worker wage bills, greater dispersion and larger changes in hours worked by contingent workers, and contingent worker's hourly wages are 11 percent lower than traditional employees'. Second, I develop a novel model of how individuals and firms choose contingent work or traditional employment. Contingent work offers hours flexibility to individuals but traditional employment earns a higher wage in equilibrium and has the security of unemployment insurance. Firms hire traditional employees before observing their TFP and must pay administrative costs to hire or fire traditional employees. They can hire (less productive) contingent workers flexibly without these constraints. I show that the recent development of apps (such as Uber) that make contingent work easy to find lowered the optimal UI replacement rate for traditional employees from 0.04 to 0.01. I also analyze a recent policy change that extended UI to contingent workers. This generates welfare losses of 0.01 percent if benefits last 6 months. Shortening the benefit duration to 1 month for contingent workers generates welfare gains of 0.02 percent.

JEL Codes: J22, J23, J65
Keywords: Contingent Work, Unemployment Insurance

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1 Introduction

Contingent workers, which include independent contractors, freelancers, consultants, gig workers, temporary agency workers, and on-call workers, typically conduct work for clients on an as-needed basis without long-term contracts. This benefits workers who prefer flexible work schedules and allows firms to quickly adjust production in response to changes in demand. However, the short-term nature of these arrangements also leaves contingent workers exposed to shocks that impact wages and opportunities for them to work. This exposure is exacerbated by the lack of policy protections (such as minimum wages) and employer-sponsored benefits (like health insurance and pension plans) that are commonly enjoyed by traditional employees (non-contingent workers). For example, contingent workers in the U.S. had been excluded from unemployment insurance (UI) programs until the Pandemic Unemployment Assistance (PUA) program of 2020, and even this was only a temporary measure during the Covid pandemic[1]. PUA data shows that substantial demand for UI exists from contingent workers[2].

This paper studies the optimal level of unemployment insurance in the presence of contingent work, when considering the incentives that drive individuals' choices and firms' hiring decisions between traditional employment and contingent work. In the first part of this paper, I use administrative tax filing data from the IRS and the National Longitudinal Survey of Youth 1979 to document novel facts about the job characteristics of contingent workers and traditional employees. I find there is greater dispersion in hours worked by contingent

[1] In comparison, the Social Security Act first established unemployment insurance programs for traditional employees in the U.S. in 1935.

[2] In the week ending on March 13, 2021, 7,349,663 contingent workers filed for continued UI benefits under the PUA program (U.S. Department of Labor, 2021). For comparison, in the same week 4,200,171 traditional employees filed for continued claims under regular state UI programs, and there were 5,515,355 continued claims under the Pandemic Emergency Unemployment Compensation program (a temporary federal program that extends the UI benefit period for traditional employees).

workers than by traditional employees: while both types work 44 hours per week on average, the standard deviation of contingent workers' weekly hours is 27 hours, while it is 15 hours for traditional employees. In addition, contingent workers' annual income is lower by 33 percent, their hourly wages are lower by 11 percent, and their job spells are on average 11 weeks shorter than those of traditional employees, even after controlling for demographics and individuals' unobserved heterogeneity.

I then develop a novel structural model that highlights the economic trade offs faced by individuals when deciding to engage in contingent work and by firms when deciding to hire traditional employees and contingent workers. Each period, unemployed individuals choose to remain unemployed or to search for contingent work or traditional employment. They find their chosen job type with some probability and otherwise stay unemployed until the following period. There are two main tradeoffs between job types. First, individuals who find contingent work can flexibly choose the number of hours to supply, whereas traditional employees receive a higher wage but must supply a fixed number of hours. Second, traditional employees receive UI benefits (which is financed by a proportional income tax) when they become unemployed. Contingent workers do not receive UI benefits after losing their job and must live on their savings until they find another job. Heterogeneous preferences over leisure and idiosyncratic productivity shocks give rise to a mix of contingent workers and traditional employees in the equilibrium of the economy.

Firms in the model face a trade off between hiring traditional employees and contingent workers. They must hire traditional employees before observing their idiosyncratic TFP shock, but can hire contingent workers afterwards. This creates an asymmetric distortion as firms that receive a high TFP shock can flexibly adjust total employment upwards while firms that receive a low shock cannot immediately lower their total employment. However, traditional employees are more productive since they are hired first and receive training before production starts. In addition, firms must pay administrative costs to hire or fire traditional employees. This further distorts firms' decisions because firms that expect to receive a low TFP shock have to pay firing costs to adjust their employment level downwards. In contrast, firms that expect to receive a high TFP shock can choose between paying adjustment costs to hire (more productive) traditional employees or hiring contingent workers freely without adjustment costs.

After carefully calibrating my model, I examine how the availability of contingent work affects the optimal UI replacement rate for traditional employees. Under the prevailing policy in the U.S., UI replaces 40 percent of wage income for traditional employees after they lose their job and the benefit duration is 6 months. The optimal replacement rate is a much smaller 4 percent. After introducing a technological change that makes contingent work easy to find (for example, recent development of apps or websites such as Uber, Upwork, or Fiverr), individuals are able to exit unemployment faster. This decreases the optimal replacement rate to 1 percent.

I also analyze how extending UI to contingent workers affects labor markets and welfare. Providing the same 40 percent replacement rate to both contingent workers and traditional employees generates welfare losses of 0.01 percent in consumption-equivalent units (relative to the baseline policy with a 40 percent replacement rate only for traditional employees). The source of these welfare losses is twofold. First, the taxes required to fund the extended UI benefits lower contingent workers' net wages, and so they supply fewer hours. (This distorts the intensive margin of contingent workers' decisions.) Second, contingent workers who lose their job have less incentive to immediately search for a new job because the UI benefits help them smooth consumption. (This distorts the extensive margin.) Total contingent hours decrease, which puts upward pressure on the relative wage of contingent workers. This makes it more expensive for firms to adjust their production levels, and so total GDP (and aggregate consumption) decreases by 0.22 percent. Consequently, while extending UI benefits helps more individuals smooth consumption during unemployment spells, the level decrease in consumption dominates and results in welfare losses. I also consider a policy that extends UI benefits to contingent workers but shortens the benefit duration to 1 month. This alternative policy creates a balance between the job search disincentives and the benefits of consumption insurance, which generates welfare gains of 0.02 percent in consumption-equivalent units.

Related Literature

This paper contributes to the literature that studies the use of contingent work and traditional employment by individuals and firms. Previous papers studying individuals' decisions include Garin, Jackson, Koustas, and McPherson (2020), Koustas (2018), Mas and Pallais (2017), and Lim (2017). Garin, Jackson, Koustas, and McPherson (2020) and Koustas (2018) find that individuals start freelance work in the online platform economy in order to smooth consumption after receiving low-income shocks in their primary job. Mas and Pallais (2017) conduct an experiment to estimate individuals' value of alternative work arrangements. They find that only a tail of workers are willing to pay for scheduling flexibility, although their analysis was limited to job applicants at a national call center and thus is not necessarily representative of the U.S. workforce. Lim (2017) estimates that young mothers value schedule flexibility in self-employment at $7,400 annually, which is about 25 percent of the average wage and salary earnings among this group. My paper develops a model that incorporates a trade off between schedule flexibility and wage differentials into the choice to be a contingent worker or a traditional employee.

On the firm side, Dube and Kaplan (2010) find that firms outsourced janitorial and security guard work in order to reduce compensation to workers. Similarly, Goldschmidt and Schmieder (2017) study German firms that outsource logistics, cleaning, security, and food services. They conclude that firms outsource these labor services to avoid paying establishment-level wage premia to workers outside their core workforce. By surveying private sector establishments, Houseman (2001) finds that, in addition to reducing labor costs, firms hire on-call, contract, and temporary agency workers in order to adjust for workload fluctuations and staffing absences and to screen workers for regular positions. My paper builds on these empirical results as firms in my model consider relative wages, productivity risk, and labor adjustment costs when choosing how many traditional employees and contingent workers to hire. I contribute to this strand of the literature by using this model to quantify the impact of each of these factors in firms' hiring decisions. To my knowledge, this is the first paper that considers how individuals' choices to engage in contingent work interact with firms' hiring decisions in general equilibrium.

Finally, this paper is related to the literature that studies UI policies in the presence of incomplete markets (Hansen and Imrohoroğlu, 1992; Shimer and Werning, 2008; Koehne and Kuhn, 2015; Kroft and Notowidigdo, 2016; Braxton, Herkenhoff, and Phillips, 2020; Birinci and See, 2021). Unlike these previous papers, my paper considers both contingent workers and traditional employees and studies how differences between their UI policy treatment distort their labor markets. Abraham, Houseman, and O'Leary (2020) discuss the historical reasons for the UI policy differences and propose several policy reforms. My paper develops a structural model to quantitatively analyze UI policies when considering how the economic trade offs between contingent work and traditional employment shape labor markets. Studying both individual and firm motivations in a single theoretical framework allows me to estimate how UI policy reforms would affect equilibrium outcomes such as the gap between wages of traditional employees and contingent workers, the share of the workforce that chooses contingent work, the distribution of hours worked, the ratio of contingent workers to traditional employees hired by firms, and total output. Taken together, these changes have important implications for the overall welfare effects of UI policy reforms.

Layout

The rest of the paper is organized as follows. Section 2 provides details of the data used in this paper and reports the empirical results about the differences between contingent workers and traditional employees. Section 3 describes the model and equilibrium, while Section 4 discusses the mechanisms of the model. Section 5 describes the calibration and estimation, and Section 6 presents the main policy results. Lastly, Section 7 concludes.

2 Empirical Facts

In this section, I use firm-level administrative tax data and household survey data to document three key facts about contingent work:

1. (Fact 1 is currently under IRS disclosure review.)
2. The variance in the cross-sectional distribution of weekly hours worked is larger for contingent workers than for traditional employees. Contingent workers also have larger changes in hours over time.
3. Contingent workers have lower annual income (-30%), lower hourly wages (-11%), and shorter job spells (-11 weeks) relative to those of traditional employees.

2.1 Firms and Contingent Work

Sources of how firms use contingent workers versus traditional employees is currently limited. My firm-side analysis utilizes confidential administrative data from the Internal Revenue Service (IRS). This panel dataset includes the entire universe of U.S. tax returns from all firms and individuals for 2000 through 2018. For the analyses using this data, I define *traditional employees* as Form W-2 recipients and *contingent workers* as individuals that 1) receive a Form 1099-MISC, 2) did not hire any W-2 or 1099 worker themselves and 3) had less than $10K in Schedule C deductions (not including car or driving expenses); this definition follow Lim, Miller, Risch, and Wilking (2019). I match each firm to their W-2 and 1099 recipients using their Employer Identification Number (EIN). I include all firms that hired at least one W-2 employee, which is about X firms per year.

Table X shows the share of firms that hire contingent workers and the mean, standard deviation, and quantiles of the compensation ratio (the total IC Form 1099-MISC compensation issued by the firm divided by the sum of IC Form 1099-MISC compensation and W-2 wage and salary compensation) for each year of the panel. X percent of firms hire IC's and about X percent of the total wage bill is paid to these workers.

Next, I examine how firms adjust their compensation to each labor type. For each year t and firm i, I calculate the percentage change to the firm's 1099 compensation to IC's as:

$$\%\Delta(ICComp_{it}) = \frac{ICComp_{it} - ICComp_{i,t-1}}{ICComp_{i,t-1}} * 100 \tag{1}$$

I similarly calculate each firm's percent change to W-2 compensation for traditional employees[3]. Then, I binned firm/year observations based on the percent change to each type of labor, and calculated the share of observations in each bin. The lowest bin is the share with

[3] I dropped firms/year observations that did not hire any of the given labor type during the previous year as the percentage change would not be defined.

a change of -100 percent and the highest bin is the share with a change of greater than 200 percent. The remaining bins have a width of 5 percent (for example, the share of firms whose adjustment was between 0 and 5 percent in a given year).

Figure X shows the distributions of how firms adjust each type of labor. The solid red bars show the changes to traditional employee W-2 compensation, while the black outlined bars show the adjustment to IC 1099 compensation. (THIS FIGURE IS CURRENTLY UNDER IRS DISCLOSURE REVIEW.)

2.2 Individuals and Contingent Work

In order to examine the characteristics of contingent workers (such as demographics, education, and hours), I use the National Longitudinal Survey of Youth 1979 (NLSY79). This is a national panel survey of the cohort of individuals born in the years 1957-1964 and it is administered by the U.S. Bureau of Labor Statistics. The survey was conducted annually between 1979 through 1994, and has been conducted biannually in even-numbered years since then. I mainly use the data starting in 1994 as that was the first year that includes questions about whether an individual worked a contingent job (defined below). I also use the survey's data on individual and household demographics, work characteristics, income, and assets.

Starting in 1994 (and except in 2000), the NLSY79 included questions about whether the respondent was an independent contractor, consultant, freelancer, temporary agency worker, on-call worker, or contract worker at each job they had during the survey period. I define each of a respondent's jobs as *contingent work* if they respond "yes" to any of these questions, and *traditional work* if they responded "no" to any of these questions and are not self-employed. Next, I calculated the total income earned by the respondent from each job they worked since the last survey interview, and defined a respondent's *primary job* as the one that earned them the most income. I then defined a respondent as a *contingent worker* if their primary job was contingent work, and a *traditional employee* if their primary job was traditional work.

Table 1 shows summary statistics of individuals in the NLSY79, categorized by job type. Columns (1) and (2) include individuals who only held traditional employment or contingent jobs, respectively. Column (3) includes individuals whose primary job was traditional employment and also worked at least one contingent job in the survey period, while Column (4) includes individuals who were primarily contingent workers but also had at least one traditional employment job in the survey period. Based on the definition of job types, approximately 5 percent of the individuals in the sample are contingent workers. This share is lower than the 7 to 10 percent that has previous studies have reported (Katz and Krueger, 2019; Lim, Miller, Risch, and Wilking, 2019), although this is not surprising as Abraham, Haltiwanger, Sandusky, and Spletzer (2018) find that household survey data usually gives lower estimates of the contingent share than estimates from administrative data due to under-reporting.

Relative to traditional employees, a slightly smaller share of contingent workers are white, married, have at least a high school degree, or have children. This is consistent with previous findings (Gale, Holmes, and John, 2018). In addition, they are less likely to have health insurance, and contingent workers who do have health insurance are less likely to receive it from their employer. The next two subsections examines empirical differences between the work characteristics of traditional employment and contingent work that are economically relevant for individuals' decisions over job type.

Table 1: Summary Statistics

	Employee Only (1)	Contingent Only (2)	Primary Emp, Also Cont (3)	Primary Cont, Also Emp (4)
Average Observations per Year	5194	263	80	20
Female	0.48	0.46	0.47	0.55
White	0.84	0.77	0.83	0.78
Black	0.13	0.19	0.15	0.18
Non-White, Non-Black	0.03	0.04	0.02	0.04
No Degree	0.09	0.14	0.08	0.07
High School Degree	0.52	0.51	0.50	0.43
Associate or Junior College	0.09	0.08	0.12	0.14
Bachelor's Degree	0.18	0.17	0.18	0.19
Graduate Degree	0.10	0.10	0.13	0.16
Never Married	0.14	0.18	0.14	0.21
Married	0.63	0.53	0.63	0.48
Other Marital Status	0.23	0.28	0.23	0.31
No Children	0.40	0.47	0.39	0.45
1 Child	0.22	0.18	0.21	0.22
2 or More Children	0.38	0.34	0.41	0.34
No Health Insurance	0.12	0.29	0.15	0.37
Current/Former Employer	0.64	0.26	0.51	0.29
Spouse's Employer	0.12	0.16	0.16	0.12
Bought Directly	0.02	0.07	0.06	0.06
Government Program	0.03	0.08	0.04	0.02
Other Source	0.06	0.13	0.08	0.15

Contingent Only are workers who were independent contractors, consultants, freelancers, temporary agency workers, on-call workers, or contract workers at each of their jobs during the survey period. *Employee Only* includes workers who did not hold any contingent work job and are not self-employed. *Primary Emp, Also Cont* are workers whose primary job (the job that earned them the most income in the survey period) was traditional employment but also held at least one contingent work job. *Primary Cont, Also Emp* are workers whose primary job was contingent work but also held at least one traditional employment job.

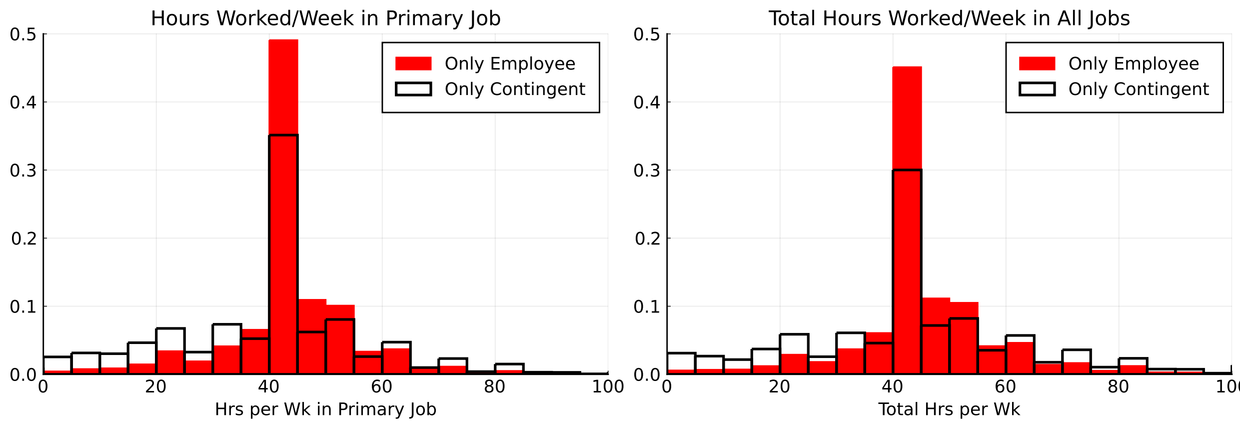

Figure 1: Distribution of Hours Worked, by Job Type

Only contingent are workers who were independent contractors, consultants, freelancers, temporary agency workers, on-call workers, or contract workers at each of their jobs during the survey period. *Only employee* includes workers who did not hold any contingent work job and are not self-employed.

2.2.1 Hours Worked

Now, I examine the weekly hours of only traditional employees and only contingent workers. On average, both types work approximately 40 hours per week, which is a standard, full-time work week in the U.S. However, the standard deviation for contingent workers is 17 hours, while the standard deviation for traditional employees is 11 hours. The left panel of Figure 1 shows a visual representation of these hours distributions. Looking at the red bars, approximately 50 percent of individuals who are only traditional employees work 40-45 hours per week in their primary job, and an additional 20 percent work 45-55 hours per week. In comparison, the distribution for individuals who are only contingent workers (the outlined black bars) is much less concentrated around the standard, full-time workweek. While the greatest share of these workers also falls into the 40-45 hours per week bin, this share is only 35 percent. Furthermore, 50 percent of only contingent workers are fairly evenly distributed over the intervals of less than 40 hours or more than 55 hours per week. Thus, it is more common for contingent workers to work either part-time or over-time, compared to traditional employees who generally have standard, full-time work weeks.

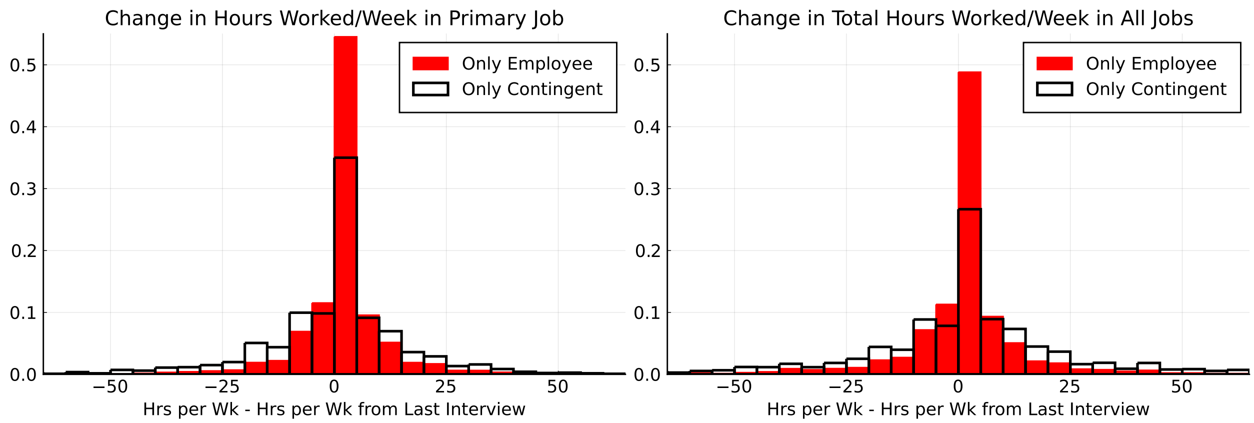

Figure 2: Distribution of Change in Hours Worked, by Job Type

Only contingent are workers who were independent contractors, consultants, freelancers, temporary agency workers, on-call workers, or contract workers at each of their jobs during the survey period. *Only employee* includes workers who did not hold any contingent work job and are not self-employed.

I next consider the possibility that individuals supplement their hours by working multiple jobs. The right panel of Figure 1 displays the distributions of total hours worked per week, which includes hours worked in the primary job and in secondary jobs whose with job spells overlapping with the primary job spell. Contingent workers and traditional employees both work 44 total hours per week on average. The standard deviation of contingent workers is 27 hours, which is nearly double the standard deviation of 15 hours for traditional employees. In addition, the figure shows that total hours is even more uniformly distributed for contingent workers than when considering hours only in the primary job, while the distribution for traditional employees remains mostly unchanged. Thus, the differences in the hours distributions between the two types of workers become even starker when considering both primary and secondary jobs.

The evidence up to this point indicates that contingent workers are more likely to work either part-time or over-time. Now look at whether individuals have more flexibility to change their hours from one period to the next. Figure 2 shows the distribution of the change in hours worked per week, where the change is between the current and previous

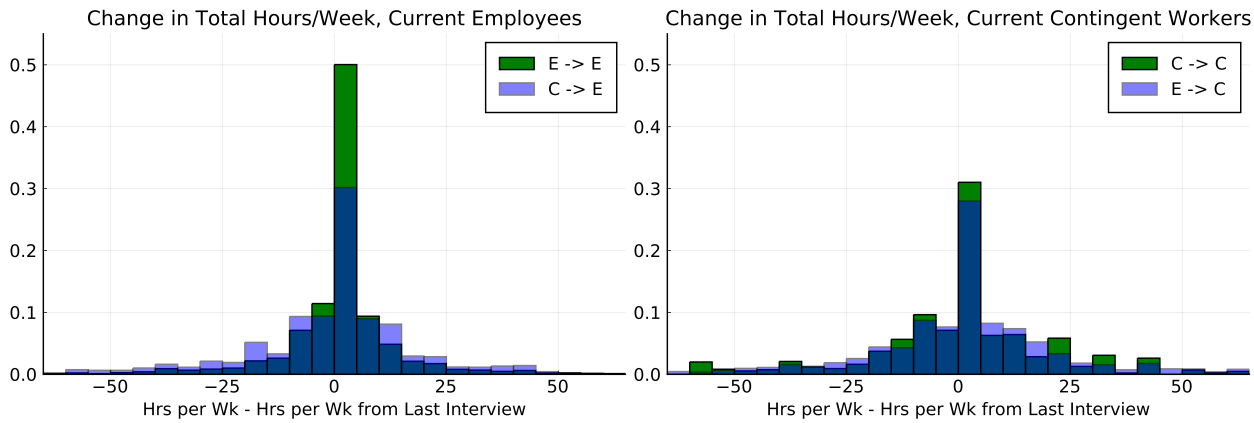

Figure 3: Distribution of Change in Hours Worked for Stayers vs Movers, by Job Type

Contingent workers (C) are individuals who were independent contractors, consultants, freelancers, temporary agency workers, on-call workers, or contract workers at each of their jobs during the survey period. *Employee* (E) includes workers who did not hold any contingent work job and are not self-employed.

survey periods (a two-year lag). The left panel includes hours worked in the primary job while the right panel considers total hours worked in all jobs. Most individuals with only traditional employment work the same number of weekly hours from one survey period to the next since their distribution in both panels is concentrated around 0. The distribution for only contingent workers shows that a greater share of these workers have larger changes in hours (in magnitude). This shows that there is greater volatility in the hours worked by contingent workers from one period to the next.

Figure 3 further divides the distributions of change in total hours based on whether individuals had the same job type (dark green bars) or opposite job type (light blue bars) in the previous survey period. The distributions for individuals who were contingent workers in both periods or traditional employees in both periods are slightly more concentrated around 0 but remain largely unchanged. What is interesting to note is that the distribution for individuals who were contingent workers in both periods is very similar to the distributions for individuals who switched job type (in either direction). These results suggest that it may be easier for contingent workers to adjust their hours than it is for traditional employees.

2.2.2 Income, Wages, and Employment Spells

In this subsection, I examine the differences between income and work characteristics of traditional employees and contingent workers. Table 2 shows the regression results from the following equation:

$$
\begin{aligned}
Y_{it} = \alpha + \beta_1 ContOnly_{it} + \beta_2 EmpPrim\&ContSec_{it} \\
+ \beta_3 ContPrim\&EmpSec_{it} + \beta_4 X_{it} + \gamma_i + \theta_t + \epsilon_{it}
\end{aligned} \tag{2}
$$

where i denotes households and t denotes the interview year. The dependent variable Y_{it} is the log of the individual's real annual income ($\ln(AnnInc_{it})$), the log of the real hourly wage in the primary job ($\ln(Wage_{it})$), and the number of weeks worked in the primary job ($WksInJob_{it}$) in the respective regressions. $ContOnly_{it}$ is an indicator variable for whether the individual only worked contingent jobs since the last survey interview, $EmpPrim\&ContSec_{it}$ is an indicator for whether the individual is primarily a traditional employee but also had contingent work, and $ContPrim\&EmpSec_{it}$ is an indicator for whether the individual is primarily a contingent worker but also had a traditional employment job. Thus, the primary coefficients of interest are β_1, β_2, and β_3 as they show the difference in the dependent variables for these groups of workers relative to individuals who only worked traditional employment jobs. The remaining terms are a vector of demographic characteristics[4] X_{it}, an individual fixed effect γ_i, a time fixed effect θ_t, and the residual ϵ_{it}.

The first two columns of Table 2 show that individuals who work any contingent job earn less than individuals who only have traditional employment jobs. In particular, individuals earn 32.6 percent less per year if they only work in contingent jobs, even after accounting for

[4]The demographic characteristics included in X_{it} include the individual's sex, race, education, marital status, and a quadratic in age. In the regressions with individual fixed effects, the sex and race variables are removed from X_{it} as they do not change over time.

Table 2: Coefficients from Regressions on Work Characteristics

	ln($AnnInc$)		ln($Wage$)		$WksInJob$	
	(1)	(2)	(3)	(4)	(5)	(6)
ContOnly	−0.632***	−0.326***	−0.232***	−0.108***	−20.40***	−10.98***
	(0.032)	(0.027)	(0.021)	(0.019)	(1.702)	(2.069)
Emp&Cont	−0.168***	−0.084*	−0.026	−0.032	4.87	6.44**
	(0.044)	(0.038)	(0.026)	(0.022)	(3.987)	(3.122)
Cont&Emp	−0.286***	−0.181*	−0.057	−0.003	−1.42	−1.53
	(0.084)	(0.083)	(0.070)	(0.053)	(−0.247)	(10.062)
Demographics	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Individual FE	No	Yes	No	Yes	No	Yes
R^2	0.247	0.690	0.187	0.615	0.070	0.256
N	55252	54626	59732	59241	61011	60530

Statistically significant at the: *10% level **5% level ***1% level.
Huber-White standard errors are in parentheses. Person-level survey weights were used in all regressions. *ContOnly* is a dummy variable for workers who only held contingent jobs in the survey period, *Emp&Cont* indicates workers whose primary job was traditional employment but also held at least one contingent job, and *Cont&Emp* indicates workers whose primary job was contingent work but also held at least one traditional employment job. Thus, coefficients denote differences from only traditional employees.

individual fixed effects. The difference is slightly lower for individuals who are primarily contingent workers but have traditional employment (18.1 percent) and those who are primarily traditional employees with some contingent work (8.4 percent). The magnitude of these differences is about twice as large when individual fixed effects are excluded, as in Column (1). This suggests there is some selection into who chooses to work contingent jobs. Nevertheless, even after controlling for the unobserved heterogeneity, the differences in annual income for contingent workers remains both statistically and economically significant.

Next, I analyze how much of the difference in annual income for contingent workers comes from differences in hourly wages and job spell length. Columns (3) and (4) show regression results when the dependent variable is the log of the worker's hourly wage from their primary job, and the dependent variable in columns (5) and (6) is the spell length of the individual's primary job (in weeks). The first row of Column (4) shows that individuals who work only contingent jobs have about a 10.8 percent lower hourly wage and their primary job spell was about 11 weeks shorter, relative to individuals who only have traditional employment. This is a difference of 11.8 percent as the spell length for only traditional employees is 93 weeks[5]. These differences in the hourly wage and job spell length are both statistically and economically significant, and they help explain the lower annual income for individuals only working contingent jobs. This contrasts with the results for individuals with both traditional employment and contingent work. Their hourly wages and job spell lengths are not statistically different from those of individuals with only traditional employment.

The data show that contingent workers have a higher dispersion in weekly hours worked and they have lower income, earn lower hourly wages and shorter job spells. The model in the following section captures these features as results of optimal individual behavior in an environment where workers differ in their valuation of leisure and firms, who are subject to productivity shocks, face a tradeoff between hiring flexible contingent labor hours and rigid, more productive traditional employees.

3 Model

This section presents a model of the labor market for traditional employees and contingent workers. Unemployed individuals choose whether to remain unemployed or to search for contingent work or traditional employment. Contingent workers get to make an intensive labor supply choice each period and are compensated at the contingent work wage. Traditional employees must work a fixed, given number of hours and receive the traditional employment wage, which is higher in equilibrium than contingent workers' wages. Individuals remain

[5] The true difference in the spell length is likely even larger as the jobs of some contingent workers (such as temporary agency workers, independent contractors, and freelancers) are coded as a single employment spell even though they had assignments or contracts at different firms.

in the same job type until they receive an exogenous separation shock or choose to quit. UI benefits depend on the type of job an individual last held; in the baseline policy, only traditional employees who lose their job exogenously receive UI benefits. Thus, when unemployed individuals choose their job type, they must weight hours flexibility against higher wages and the security of UI.

Firms receive persistent idiosyncratic TFP shocks and they choose their factor inputs to maximize the present discounted value of profits. They hire traditional employees before their idiosyncratic TFP is realized, while they can choose contingent worker hours after they receive their productivity shock. Since traditional employees are hired first, firms have time to train them before production starts. In contrast, contingent workers must spend some of their time on the job to train and thus have lower productivity. In equilibrium, this productivity difference supports higher wages for traditional employees. This gives rise to the tradeoff individuals face between hours flexibility and higher wages. In addition, firms must pay hiring or firing costs in order to adjust their level of traditional employment from their choice in the previous period. Thus, firms face a tradeoff between productivity, ability to adjust their workforce after observing their TFP shock, and administrative costs to adjust their number of traditional employees. Wages for traditional employees and contingent workers are determined in separate Walrasian markets.

3.1 Environment

Time is discrete and the horizon is infinite. The economy is populated by a measure 1 of individuals. Each individual i draws a type θ_i from a distribution $G_1(\theta)$, which is fixed over their lifetime and governs their disutility from work. In each period t, individuals get an idiosyncratic productivity shock $z_{i,t} \sim G_2\left(z \mid z_{i,t-1}\right)$. These productivity shocks are perfectly observable by firms, and so individuals who work n hours are compensated for their $z_{i,t}n$ effective hours. Individuals also receive i.i.d. taste shocks $\epsilon = \left(\epsilon^E, \epsilon^C, \epsilon^B, \epsilon^U\right) \sim G_3(\epsilon)$ over traditional employment E, contingent work C, both job types B, and unemployment U.[6]

Unemployed individuals choose whether to remain unemployed or to search for a traditional employment job or contingent work. Individuals currently with contingent work or traditional employment choose to quit into unemployment, keep only their current job, or search to gain the other job type. Individuals with both job types choose to keep both jobs or to quit either or both of their jobs. Individuals that choose to search find their chosen job type with probability p^j (for $j \in \{E, C\}$). If an unemployed individual searches for traditional employment and does not find it, they can then search for contingent work, with the same job-finding probability p^C.[7] Individuals who choose to quit can do so with certainty.

Contingent workers choose how much labor to supply $n^C_{i,t} \geq 0$ for that period and earn wage w^C_t. Traditional employees must supply a fixed amount of labor $\tilde{n}^E$ at wage w^E_t. Individuals with both job types supply $\tilde{n}^E$ units of labor at wage w^E_t and can work additional hours, but there is a fixed flow utility cost κ^B that represents extra effort required to balance multiple jobs types. Individuals receive an exogenous separation shock at rate δ^j. After receiving this shock, unemployed individuals get UI benefits that depend on their most recent type of job and expire with probability χ^j each period[8]. (Multi-job holders are only eligible for UI

[6] Assuming that individuals receive taste shocks over job type is a computational convenience to smooth the continuation value in their Stage 2 optimization problems, as in McFadden (1973) and Iskhakov, Jørgensen, Rust, and Schjerning (2017). So long as the variance of the distribution of taste shocks is small enough, this assumption will not drive the main results.

[7] The traditional market clears before the contingent market does. Consequently, unemployed individuals that choose to search for contingent work and fail to find a job cannot then search for traditional employment in the same period.

[8] The assumption that UI benefits expire stochastically simplifies the solution of the model as it eliminates the need to include the benefit duration as a state variable. This assumption is standard in the literature, as in Koehne and Kuhn (2015).

if they lose both jobs in the same period. If this occurs, they receive traditional employee UI benefits.) The government finances these benefits with a proportional income tax τ_t^j: tax revenue collected from traditional employment (contingent work) income funds unemployment insurance to former traditional employees (contingent workers). The government also collects a labor income tax τ_t^y and a tax on firm profits at rate τ_t^π to fund government expenditures g_t. Individuals can save by buying shares $a_{i,t+1}$ of firm ownership at price q_t. They seek to maximize their expected sum of periodical utilities $u(c, n; \theta)$, discounted by the factor $\beta \in (0, 1)$.

The economy also has a continuum of firms of measure 1. Each firm receives an idiosyncratic TFP shock $z_t^F \sim G_4\left(z_t^F \mid z_{t-1}^F\right)$, which depends on their shock z_{t-1}^F from the previous period. Firms produce output according to the production function $f\left(\ell_t^E, \ell_t^C\right)$, where ℓ_t^E and ℓ_t^C are the number of traditional employee and contingent worker hours hired[9], respectively. Traditional employees are more productive. However, firms must choose ℓ_t^E knowing only the distribution $G_4(\cdot \mid z_{-1}^F)$, whereas they can choose ℓ_t^C after observing their z_t^F for the period. In addition, firms pay hiring or firing costs $\phi\left(\ell_{t-1}^E, \ell_t^E\right)$ to adjust traditional employment from their level in the previous period ℓ_{t-1}^E. These administrative costs are a waste. Firm owners seek to maximize the expected sum of profits, discounted by the rate β.

3.2 Timing

As previously mentioned, time is discrete. Each period is divided into two stages. At the beginning of Stage 1, individuals receive their idiosyncratic productivity shock and taste

[9]Firms are not restricted to hiring an integer number of workers or all of the hours supplied by a given individual. In addition, firms have perfect information about an individual's idiosyncratic productivity and wages are paid per effective hour. Thus, ℓ_t^E and ℓ_t^C actually denote the effective hours that a firm hires. While a traditional employee must supply a fixed number of hours $\tilde{n}^E$, these hours can be divided among many firms. This assumption is a simplification to avoid keeping track of firm-worker matches that does not affect the essential tradeoffs that the model is meant to highlight.

shocks over job types. Unemployed individuals choose whether to remain unemployed or to search for the contingent worker market or the traditional employee market; employed individuals choose whether to keep their current job type(s), quit, or search to gain the other job type. Individuals searching for a job find their chosen market with probability p^j for $j \in \{E, C\}$. Firms choose how many traditional employee hours to hire, given their previous period's traditional employment choice and TFP shock. At the end of Stage 1, the wage w_t^E clears the market for traditional employees.

In Stage 2, individuals in the contingent worker market choose how much labor to supply. Firms observe their idiosyncratic productivity for the period. They then choose how many contingent worker hours to hire and the wage w_t^C clears this market. Firms produce output and pay wages and dividends, the unemployed receive UI benefits, and individuals consume based on their consumption and savings decisions. At the end of the period, jobs separate with probability δ^j, unemployment benefits expire with probability χ^k.

3.3 Individuals' Problem

3.3.1 Stage 1

This subsection presents individuals' decision problems; I will suppress subscripts i and t when they are not needed for clarity. First, consider an individual who begins Stage 1 unemployed. They know their type θ, stock shares a from the previous period, and their UI benefit type $h \in \{E, C, N\}$. Here, $h = N$ denotes individuals who will not receive UI because their benefits have expired or they quit their job. They receive their taste shocks $\epsilon = \left(\epsilon^E, \epsilon^C, \epsilon^B, \epsilon^U\right)$ over job types, and their productivity shock z is also realized. Given these states, the individual makes a discrete choice over job types:

$$V_\theta^{U1}(h,a,z,\epsilon) = \max\Big\{p^C V_\theta^{C2}(a,z) + (1-p^C)V_\theta^{U2}(h,a,z) + \epsilon^C, \tag{3}$$

$$p^E V_\theta^{E2}(a,z) + (1-p^E)\max\left\{p^C V_\theta^{C2}(a,z) + (1-p^C)V_\theta^{U2}(h,a,z), V_\theta^{U2}(h,a,z)\right\} + \epsilon^E,$$

$$V_\theta^{U2}(h,a,z) + \epsilon^U\Big\}$$

where V_θ^{E2}, V_θ^{C2}, and V_θ^{U2} are the Stage 2 value functions of traditional employees, contingent workers, and unemployed individuals, respectively.

Individuals who currently have a contingent job choose whether to search for traditional employment, to work in only their contingent job, or to quit into unemployment (without UI benefits):

$$V_\theta^{C1}(a,z,\epsilon) = \max\Big\{p^E V_\theta^{B2}(a,z) + (1-p^E)V_\theta^{C2}(a,z) + \epsilon^B, \tag{4}$$

$$V_\theta^{C2}(a,z) + \epsilon^C,\;\; V_\theta^{U2}(N,a,z) + \epsilon^U\Big\}$$

The Stage 1 problem for traditional employees is very similar, except that the probability that they become a multi-job holder is p^C:

$$V_\theta^{E1}(a,z,\epsilon) = \max\Big\{p^C V_\theta^{B2}(a,z) + (1-p^C)V_\theta^{E2}(a,z) + \epsilon^B, \tag{5}$$

$$V_\theta^{E2}(a,z) + \epsilon^E,\;\; V_\theta^{U2}(N,a,z) + \epsilon^U\Big\}$$

Lastly, multi-job holders in Stage 1 choose whether to remain a multi-job holder or to quit either or both of their jobs:

$$V_\theta^{B1}(a,z,\epsilon) = \max\Big\{V_\theta^{E2}(a,z) + \epsilon^E,\;\; V_\theta^{C2}(a,z) + \epsilon^C, \tag{6}$$

$$V_\theta^{B2}(a,z) + \epsilon^B,\;\; V_\theta^{U2}(N,a,z) + \epsilon^U\Big\}$$

3.3.2 Stage 2

In Stage 2, contingent workers with type θ and state (a, z) choose consumption c, stock shares a', and how much labor to supply n^C to solve the following problem:

$$\begin{aligned}
V_\theta^{C2}(a,z) = \max_{c,a',n^C}\ & u\left(c, n^C; \theta\right) + \beta\mathbb{E}\Big[\left(1-\delta^C\right)V_\theta^{C1}(a', z', \epsilon') \\
& + \delta^C V_\theta^{U1}(C, a', z', \epsilon') \mid z\Big] \\
\text{s.t.} \qquad & c + qa' = \left(1 - \left(\tau + \tau^C\right)\right) z w^C n^C + (d+q)\,a \\
& c, a', n^C \geq 0
\end{aligned} \tag{7}$$

where $d = (1-\tau^\pi)\pi$ is stock dividends, which are equal to after-tax firm profits. Traditional employees solve a similar problem, although they take their labor supply $\tilde{n}^E$ as given and only choose consumption c and stock shares a'. Their Stage 2 problem is:

$$\begin{aligned}
V_\theta^{E2}(a,z) = \max_{c,a'}\ & u\left(c, \tilde{n}^E; \theta\right) + \beta\mathbb{E}\Big[(1-\delta^E)V_\theta^{E1}(a', z', \epsilon') \\
& + \delta^E V_\theta^{U1}(E, a', z', \epsilon') \mid z\Big] \\
\text{s.t.} \qquad & c + qa' = \left(1 - \left(\tau^y + \tau^E\right)\right) z w^E \tilde{n}^E + (d+q)\,a \\
& c, a' \geq 0
\end{aligned} \tag{8}$$

Multi-job holders must supply $\tilde{n}^E$ hours in the traditional employee market, but they can choose additional hours n^B in the contingent market, as well as consumption c and stock shares a' :

$$
\begin{aligned}
V_\theta^{B2}(a,z) = \max_{c,a',n^B}\ & u\left(c, \tilde{n}^E + n^B; \theta\right) - \kappa^B + \beta \mathbb{E}\Big[\delta^E(1-\delta^C)V_\theta^{C1}(a',z',\epsilon') \\
& + (1-\delta^E)\delta^C V_\theta^{E1}(a',z',\epsilon') + (1-\delta^E)(1-\delta^C)V_\theta^{B1}(a',z',\epsilon') \\
& + \delta^E\delta^C V_\theta^{U1}(E,a',z',\epsilon') \mid z\Big] \\
\text{s.t.} \qquad & c + qa' = \left(1 - \left(\tau^y + \tau^E\right)\right) zw^E\tilde{n}^E + \left(1 - \left(\tau^y + \tau^C\right)\right) zw^C n^B + (d+q)\,a \\
& c, a', n^B \geq 0
\end{aligned}
\tag{9}
$$

Note here that the separation shocks for each job type are independent. Multi-job holders are not eligible for UI if they lose only one of their jobs. However, if they lose both jobs in the same period, they receive traditional employee UI benefits.

Lastly, individuals who are unemployed in Stage 2 choose consumption c and stock shares a' to solve:

$$
\begin{aligned}
V_\theta^{U2}(h,a,z) = \max_{c,a'}\ & u\left(c, 0; \theta\right) + \beta \mathbb{E}\Big[(1-\chi^h)V_\theta^{U1}(h,a',z',\epsilon') \\
& + \chi^h V_\theta^{U1}(N,a',z',\epsilon') \mid z\Big] \\
\text{s.t.} \qquad & c + qa' = \left(1 - \tau^y\right) zb^h w^h n^h + (d+q)\,a \\
& c, a' \geq 0
\end{aligned}
\tag{10}
$$

UI replaces a share b^h of an individual's income. Former traditional employees are compensated based on an individual working $\tilde{n}^E$ hours. Contingent worker UI is provided based on the optimal hours n^C that would solve the individual's problem in (7). The replacement rates b^h and benefit expiration probabilities χ^h are both policy instruments that are set by the government. In the baseline policy, the replacement rate for traditional employees b^E is 40% and the average benefit duration is 6 months, while the replacement rate is b^C is 0% for contingent workers. This reflects the UI policy in the U.S. prior to the PUA program.

3.3.3 Preferences

The period utility function is

$$u(c, n; \theta) = \frac{c^{1-\gamma} - 1}{1 - \gamma} - \theta \frac{n^{1+\nu}}{1 + \nu} \tag{11}$$

as in Heathcote, Storesletten, and Violante (2014). γ represents the inverse of the intertemporal elasticity of substitution for consumption and ν controls the elasticity of labor supply. These parameters are common among individuals. The parameter θ governors the weight on an individual's disutility from work. It varies among the population but remains fixed throughout a given individual's life. As an individual's ideal labor supply depends on their θ type, this parameter is important for determining the cross-sectional distribution over job types and hours.

3.4 Firms' Problem

Now, I present the firms' problem. Each firm enters the period knowing their previous period's shock z_{-1}^F and traditional employment level ℓ_{-1}^E. In Stage 1, they choose how how many traditional employees ℓ^E to hire for this period in order to maximize expected profits, before observing their TFP shock z^F for the period. Since this productivity shock follows a Markov chain, the firm's Stage 1 value function $V^{F1}\left(z_{-1}^F, \ell_{-1}^E\right)$ can be written as:

$$V^{F1}\left(z_{-1}^F, \ell_{-1}^E\right) = \max_{\ell^E \geq 0} \int V^{F2}\left(z^F, \ell^E\right) dG_4\left(z^F \mid z_{-1}^F\right) - \phi\left(\ell_{-1}^E, \ell^E\right) \tag{12}$$

where $V^{F2}\left(z^F, \ell^E\right)$ is the firm's value function in the second stage. At the beginning of Stage 2, the firm observes its TFP shock z^F. They take their choice for traditional employees as given and choose contingent worker hours to solve the following problem:

$$V^{F2}\left(z^F,\ell^E\right)=\max_{\ell^C\geq 0}\; z^F f\left(\ell^E,\ell^C\right)-w^E\ell^E-w^C\ell^C+\beta V^{F1}\left(z^F,\ell^E\right) \tag{13}$$

3.4.1 Production Function

I assume that the firm production function takes the following form:

$$f\left(\ell^E,\ell^C\right)=\left(\ell^E+\lambda\ell^C\right)^\alpha \tag{14}$$

where $\lambda,\alpha\in(0,1)$. Traditional employees and contingent workers are perfect substitutes in production, up to the factor λ. This parameter represents the share of working time that contingent workers must spend for on-the-job training; traditional employees receive this training when they are hired in Stage 1, before production begins. The parameter α governs the curvature of the production function, and the assumption that $\alpha<1$ means there are decreasing returns to scale.

3.4.2 Labor Adjustment Costs

In the model, firms must pay administrative hiring or firing costs to adjust their traditional employment ℓ^E from its level in the previous period ℓ^E_{-1}. Following the prior literature (Hall, 2004; Ejarque and Portugal, 2007) this adjustment cost takes the form:

$$\phi\left(\ell^E_{-1},\ell^E\right)=\phi\frac{\left(\ell^E_{-1}-\ell^E\right)^2}{2\ell^E_{-1}} \tag{15}$$

This form implies that adjustment costs are convex in the net change in traditional employment and have constant returns to scale. As a result, firms would prefer to spread out adjustments to traditional employment over several periods rather than making large changes in a single period. The ℓ^E_{-1} in the denominator implies that for a given net change, firms with high levels of traditional employment in the previous period have lower adjustment costs. This represents the idea that large firms might maintain a separate division to handle hiring and firing within the firm, and so these administrative duties would be carried out more efficiently and thus at a lower cost.

3.5 Government

In this economy, the government's main role is to provide unemployment insurance. As previously mentioned, the baseline UI policy replaces a fraction b^E of wages for traditional employees after they lose their job, and the replacement rate for contingent workers is $b^C = 0$. The policy analysis in Section 6 will examine the effects of extending the same replacement rate to contingent workers. In both scenarios, the government also levies tax rate τ^j on labor income to balance each UI budget:

$$UI^E = \tau^E(w^E L^E) \tag{16}$$

$$UI^C = \tau^C(w^C L^C) \tag{17}$$

where L^E denotes aggregate effective traditional employee labor hours, L^C is aggregate effective contingent work labor hours, and UI^E denotes aggregate unemployment insurance paid to former traditional employees and former contingent workers, respectively In addition, the government levies tax rates τ^y on labor income and UI benefits and τ^π in order to fund government expenditures g:

$$g = \tau^y \left(w^E L^E + w^C L^C + UI^E + UI^C\right) + \tau^\pi \pi \tag{18}$$

3.6 Equilibrium

Definition 3.1. A *recursive competitive equilibrium* in the economy is value functions and policy functions for individuals and firms, prices $\left\{w^E, w^C, q\right\}$, income tax rates $\left\{\tau^E, \tau^C, \tau^y, \tau^\pi\right\}$, distributions Ω^E of traditional employees, Ω^C of contingent workers, and Ω^B of multi-job holders over states $x \equiv (\theta, a, z)$, distribution Ω^U of unemployed individuals over states (h, x), and a distribution Ψ of firms over states $\left(z^F_{-1}, \ell^E_{-1}\right)$, such that:

1. given prices and distributions, the value functions and policy functions solve the individuals' problems in (3) through (10), and the firms' problems in (12) and (13);

2. the distributions Ω^E, Ω^C, Ω^B, and Ω^U are derived from individuals' policy functions and the exogenous processes of productivity shocks z, taste shocks ϵ, death δ^D, job finding $\{p^j\}_{j\in\{E,C\}}$ and separation $\{\delta^j\}_{j\in\{E,C\}}$, UI benefit expiration $\left\{\chi^h\right\}_{h\in\{E,C\}}$, and individual types θ;

3. the distribution Ψ is derived from firms' policy functions and the exogenous process of TFP productivity shocks z^F;

4. the wage w^E clears the market for traditional employees:

$$\int \ell^E\left(x^F_{-1}\right) d\Psi\left(x^F_{-1}\right) = \sum_{j\in\{E,B\}} \int z\tilde{n}^E d\Omega^j(x)$$

5. the wage w^Cclears the market for contingent workers:

$$\int\int \ell^C\left(z^F, \ell^E\left(x^F_{-1}\right)\right) dG_4\left(z^F \mid z^F_{-1}\right) d\Psi\left(x^F_{-1}\right) = \int zn^C(x)d\Omega^C(x) + \int zn^B(x)d\Omega^B(x)$$

6. the price q clears the stock market:

$$1 = A = \sum_{j\in\{E,C,B\}} \int a(x)d\Omega^j(x) + \int a(h,x)d\Omega^U(h,x)$$

7. and the tax rates $\tau^E, \tau^C, \tau^y, \tau^\pi$ balance the government's budgets in (16), (17), and (18).

4 Discussion of Mechanisms

The main force that drives an individual's decision over job type is the tradeoff they face between higher wages as a traditional employee and the flexibility to marginally adjust their labor supply if they decide to be a contingent worker. In addition, they also consider the probabilities that they will find a job and later separate from their job, and the UI benefits that they will receive once they lose that job. For firms, they must make hiring decisions that take into account 1) the marginal rate of substitution between the two types of workers and the relative wages, 2) the risk involved in choosing traditional employees before observing their TFP shock and then hiring less productive contingent workers afterward if needed, and 3) administrative costs incurred for adjusting traditional employment from its level in the last period and potential adjustment costs in the following period. Each of these forces are analyzed below.

4.1 Individuals: Flexibility versus Wages

In Stage 1 of the model, individuals choose whether to be a traditional employee or a contingent worker. The main factors they consider is that they will receive a higher wage if they choose to be a traditional employee, but they will be able to choose labor hours as a contingent worker[10]. Their decision will then depend on the wage premium between w^E and w^C, their current productivity shock z, and their idiosyncratic weight θ on the disutility from work.

In order to illustrate how these factors affect the job choice, I assume for this discussion that

[10] For now, I assume the job finding and separation probabilities are the same for both job types and that no workers can receive UI benefits; subsection 4.2 discusses how these factors affect individuals' choices. In addition, individuals will also consider their taste shocks over job types. For this discussion, I assume that the variance of the distribution for taste shocks is so small that they have little influence on individuals' Stage 1 decisions.

individuals' utility function is slightly different than the calibration in subsection 3.3.3:

$$u(c,n;\theta) = \frac{1}{1-\gamma}\left(c - \theta\frac{n^{1+\nu}}{1+\nu}\right)^{1-\gamma} \tag{19}$$

as in Greenwood, Hercowitz, and Huffman (1988). As before, the parameters $\gamma \geq 1$ and $\nu > 0$ are common among individuals while $\theta > 0$ is heterogeneous among the population but fixed across an individual's lifetime. GHH preferences give a closed form solution for the optimal labor supply that does not depend on assets, which is convenient for this discussion to illustrate individuals' tradeoffs. However, the same arguments hold true when utility is additively separable in consumption and labor as I assume for the main quantitative results of the paper.

Individuals who chose to be contingent workers will decide how many labor hours to supply by solving their problem (7). The first order conditions give the following (interior) solution for labor hours:

$$n^{C*} = \left(\frac{(1-\tau)w^C z}{\theta}\right)^{\frac{1}{\nu}} \tag{20}$$

Since $\nu > 0$, a contingent worker's optimal labor supply is increasing in their wage w^C and productivity z and decreasing in θ. This makes sense since higher values of θ means the individual gets more disutility from work. Similarly, if traditional employees were able to choose their labor supply, the solution would be:

$$n^{E*} = \left(\frac{(1-\tau)w^E z}{\theta}\right)^{\frac{1}{\nu}} \tag{21}$$

Recall that $\tilde{n}^E$ denotes the given labor hours that an individual must supply if they decide to be a traditional employee. When the productivity shock z and wage w^E is such that the desired n^{E*} that solves equation (21) is very close to $\tilde{n}^E$, then the individual would gain little extra value from being able to choose labor hours as a contingent worker. Thus, for a given productivity shock z, individuals with a $\theta^* = \frac{(1-\tau)w^E z}{(\tilde{n}^E)^\nu}$ will choose traditional employment. Individuals with θ above this θ^* would want to work fewer hours than $\tilde{n}^E$, while individuals with a lower θ would want to work more hours. However, since $w^E > w^C$, individuals with θ close enough to θ^* will still be willing to work the fixed number of hours $\tilde{n}^E$ since the wage difference is enough to overcome their disutility from deviating from n^{E*}. For individuals with a substantially higher or lower θ, the utility loss from working a fixed number of hours different from their n^{E*} will be too large to compensate for the higher wage. As a result, there will be some cutoffs $\underline{\theta}, \overline{\theta}$ such that an individual will choose traditional employment if $\underline{\theta} \leq \theta \leq \overline{\theta}$ and contingent work otherwise. Furthermore, as the wage premium between w^E and w^C grows larger, the extra income will incentivize more individuals to choose traditional employment: $\underline{\theta}$ will decrease while $\overline{\theta}$ will increase. Figure 4 illustrates these ideas.

The solid black line in the left panels of Figure 4 show the logit probability that an individual chooses traditional employment[11] as a function of their weight on the disutility of work θ, for a fixed state and with GHH preferences[12]. The right panels of Figure 4 show the labor that traditional employees would supply if they were able to choose their hours (solid blue line) and contingent workers' labor supply (red dashed line), relative to traditional employees' required labor supply $\tilde{n}^E = 1$ (black dotted line). The traditional employee wage is $w^E = 0.5$. The wage premium $\frac{w^E}{w^C}$ is 1.1 in the top panels and 1.4 in the bottom panels. The traditional employee's desired labor supply n^{E*} intersects with their required labor supply $\tilde{n}^E$ at $\theta_z^* = 0.47$ (dashed blue line in the left panels). The top left panel shows that individuals with $\theta \in [0.3, 0.7]$ would choose traditional employment in order to receive the higher wage,

[11] Under the specification and states considered here, individuals choose to search for a job with probability > 0.99 and so the left hand panels reflect the choice between traditional employment and contingent work. They are *probabilities* over this discrete choice due to the assumption that individuals receive taste shocks for job types. Here, I have set the variance of the Type 1 extreme value distribution to 0.01 so the taste shocks have little influence over the job type decision.

[12] These comparative statics also follow for a utility function that is additively separable in consumption and labor.

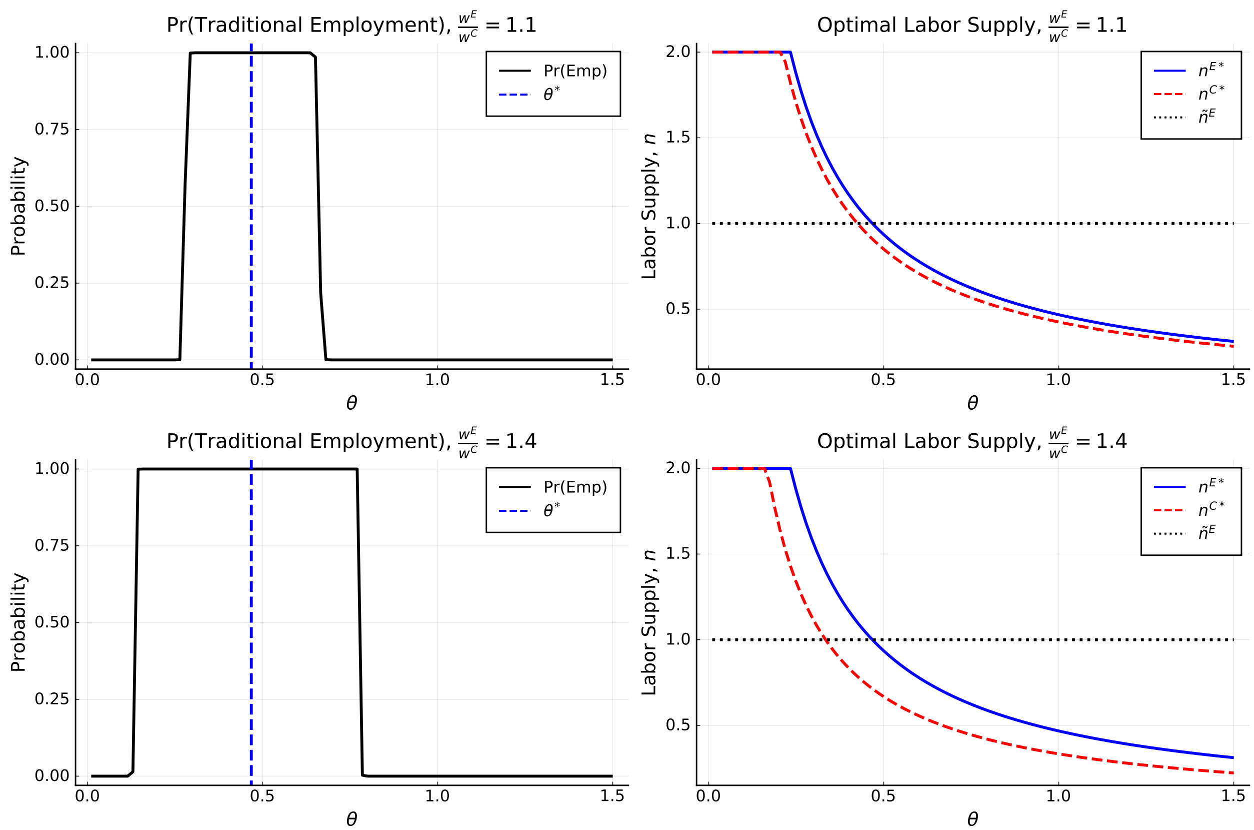

Figure 4: Effect of the Wage Premium on Job Choice

The right panels show the optimal labor supply at the traditional employment wage (solid blue line) and the contingent work wage (dashed red line) relative to the hours that traditional employees must supply (horizontal dotted black line). The solid black line in the left panels shows the logit probability of choosing traditional employment as a function of the weight on disutility from work, for a fixed state and with GHH preferences. The vertical dashed blue line shows the θ^* where n^{E*} and $\tilde{n}^E$ intersect. The wage premium is larger in the bottom panels, which causes individuals to choose traditional employment for a larger range of θ.

even though they would have to work a sub-optimal number of hours. Individuals outside this range choose contingent work so they can work either substantially more or substantially fewer hours than $\tilde{n}^E$. The wage premium is larger in the bottom panels. As discussed above, this increases the range of θ over which individuals choose to be traditional employees.

4.2 Individuals: Job Finding/Separation Probabilities and UI

In order to isolate the main tradeoff in the previous subsection, I assumed the job finding and separation probabilities are the same for both job types and that no workers can receive UI benefits. In this section, I consider how differences in these parameters by job type (to reflect differences observed in the data and the calibration used in the main analysis of section 6) affect job search decisions. The tradeoff between the wage premium for traditional employees and the hours flexibility for contingent workers still remains and so there will be a range of θ values for which individuals will choose traditional employment. This analysis illustrates how this range changes under higher job finding and separation rates for contingent workers and UI benefits for traditional employees.

Figure 5 shows the logit probability that an individual chooses traditional employment as a function of their weight on the disutility of work θ. As before, I assume that individuals have GHH preferences and I fix the traditional employee wage w^E to 0.5 and the wage premium to 1.1. In each panel, the solid black line is the same as in the top left panel of Figure 4 (where the job finding rates are $p^E = p^C = 0.5$, the job separation rates are $\delta^E = \delta^C = 0.125$, and the UI replacement rates are $b^E = b^C = 0$). The red dotted line shows the logit choice probabilities after changing the parameter considered in each panel, *ceteris paribus*.

In the top left panel, the job finding probability for contingent workers is higher at $p^C = 0.7$ than it is for traditional employees. This increases the expected value of searching for

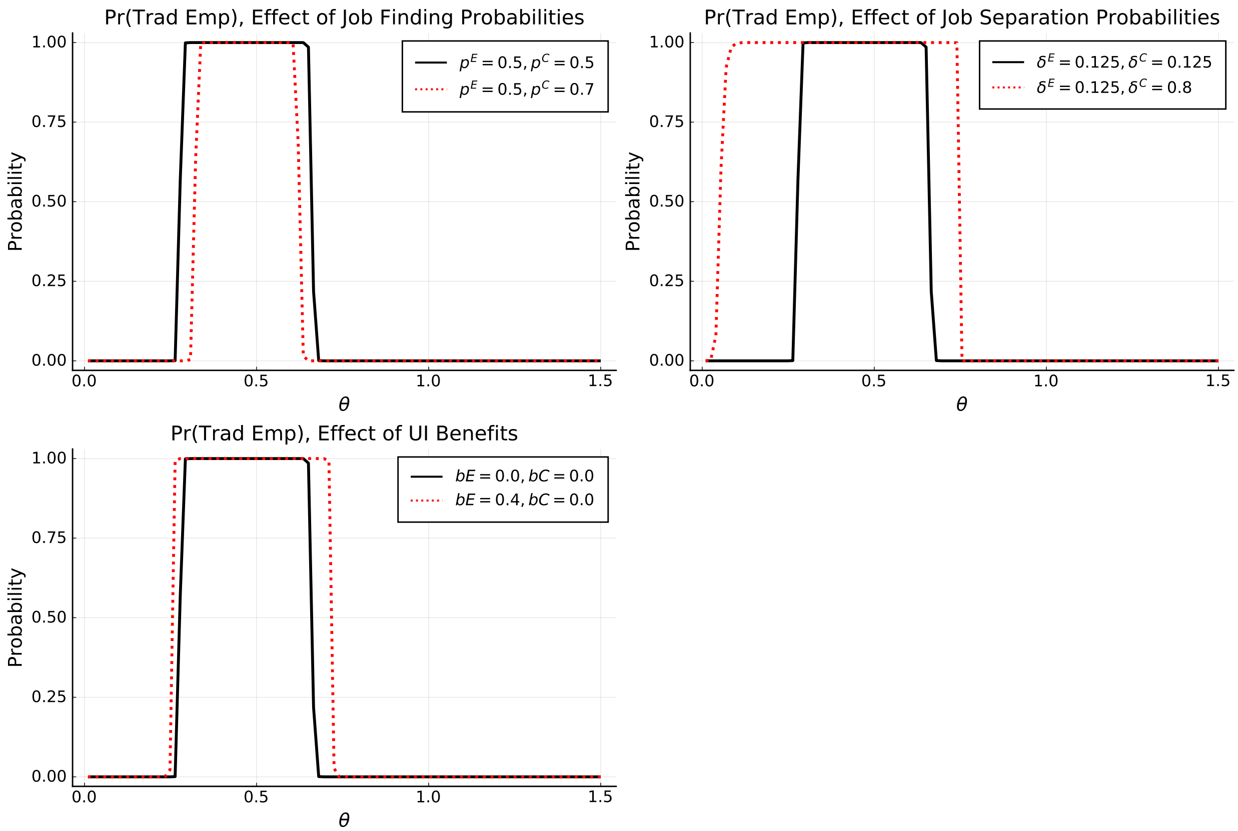

Figure 5: Effect of Job Finding/Separation Probabilities and UI on Job Choice

This figure shows how the job finding and separation rates (p^j and δ^j, respectively) and UI benefits affect the logit choice probability of choosing traditional employment as a function of the weight on disutility from work. The solid black line shows the logit probability when $p^E = p^C = 0.5$, $\delta^E = \delta^C = 0.125$, and there are no UI benefits ($b^E = b^C = 0.0$). The top left panel shows that fewer individuals search for traditional employment jobs when the job finding probability for contingent work increases. In the top right panel, contingent workers are more likely to lose their job ($\delta^C = 0.8$), which increases the range of θ over which individuals search for traditional employment. A similar effect occurs when UI benefits are offered to traditional employees with a replacement rate of $b^E = 0.4$.

contingent work, which shrinks the range of θ over which individuals search for traditional employment. In contrast, when the job separation rate δ^C increases from 0.125 to 0.8 in the top right panel, even individuals that successfully find a contingent job in the current period are likely to lose it by the following period. It is not ideal for them to lose their job, as evidenced by the fact that no individuals considered here choose to remain unemployed. As a result, individuals within a much wider range of θ search for traditional employment. Lastly, the bottom left panel shows the results when UI benefits are offered to traditional employees with a replacement rate of $b^E = 0.4$ but not to contingent workers. (I am considering the job choice of an individual who currently does not have UI benefits to make this analysis comparable to the others.) Because traditional employees will still receive some income after losing their job, the expected value of traditional employment increases. Thus, there is now a wider range of θ where individuals choose traditional employment.

4.3 Firms: Tradeoff between Productivity and Wages

This subsection discuss the tradeoffs firms face when choosing how many traditional employees and contingent workers to hire. Since all firms behave competitively, they weigh the marginal product of an additional unit of the input against its marginal cost. First, consider a simpler environment where firms can choose both traditional employment and contingent work hours after observing their TFP productivity parameter and without any labor adjustment costs. Then, a firm's profit maximization problem would be:

$$\tilde{V}^F\left(z^F\right) = \max_{\ell^E,\ell^C \geq 0} \; z^F\left(\ell^E + \lambda \ell^C\right)^{\alpha_2} - w^E\ell^E - w^C\ell^C + \beta\mathbb{E}\left[\tilde{V}^F\left(z^F_{+1}\right) \;\middle|\; z^F\right] \qquad (22)$$

In this specification, firms make both hiring choices simultaneously, and the value function no longer depends on the traditional employment level in the previous period because adjustment costs are zero. Because traditional employees and contingent workers are perfect substitutes up to the parameter $\lambda \in (0,1)$, the first order conditions for ℓ^E and ℓ^C show that firms hire only contingent workers if $\lambda > \frac{w^C}{w^E}$, and only traditional employees if $\lambda < \frac{w^C}{w^E}$.

Since the adjustment costs and timing assumptions (that traditional employees must be chosen before drawing the TFP shock) in the main model constrain the use of traditional employees but not contingent workers, if $\lambda > \frac{w^C}{w^E}$, firms continue to hire only contingent workers, regardless of the magnitude of adjustment costs or the distribution of firm shocks. Unlike in the simplified model, however, when $\lambda < \frac{w^C}{w^E}$ firms may hire a combination of traditional employees and contingent workers. For the remainder of this section, I assume that $\lambda < \frac{w^C}{w^E}$ and discuss the effects of the additional assumptions on firms' hiring decisions.

4.4 Firms: Timing of Hiring Decisions

Next, I consider a model where firms must hire traditional employees before observing their TFP shock z^F but can hire contingent workers afterward. Since I am assuming $\lambda < \frac{w^C}{w^E}$, firms would ideally like to hire only traditional employees. However, if they hire a large number of traditional employees and end up receiving a low TFP shock, they will not be able to adjust total labor downward. Thus, firms make their Stage 1 decision by balancing the higher marginal productivity of traditional employees against their inability to adjust labor downward in case they observe a low TFP shock. Knowing that they can always hire contingent workers to increase total employment in Stage 2 (if they observe a high TFP shock), firms choose to hire fewer traditional employees in Stage 1.

To see this, consider the firm's Stage 1 problem in this simplified model:

$$\hat{V}^{F1}\left(z_{-1}^F\right) = \max_{\ell^E \geq 0} \int \hat{V}^{F2}\left(z^F, \ell^E\right) dG_4\left(z^F \mid z_{-1}^F\right) \tag{23}$$

Their Stage 2 problem is the same as equation (13) in the full model, except that the continuation value does not depend on ℓ^E:

$$\hat{V}^{F2}\left(z^F, \ell^E\right) = \max_{\ell^C \geq 0} \; z^F\left(\ell^E + \lambda \ell^C\right)^\alpha - w^E \ell^E - w^C \ell^C + \beta \hat{V}^{F1}\left(z^F\right) \tag{24}$$

First, note that under the assumption that $\lambda < \frac{w^C}{w^E}$, the firm hires at least as many traditional employees as they would if they were to receive the lowest TFP shock. Then, the the first order condition of the maximization problem in (24) shows that a firm's hiring decision for contingent workers is:

$$\ell^C\left(z^F, \ell^E\right) = \max\left\{\frac{1}{\lambda}\left(\frac{\lambda \alpha z^F}{w^C}\right)^{\frac{1}{1-\alpha}} - \frac{\ell^E}{\lambda}, 0\right\} \tag{25}$$

Since $\alpha, \lambda \in (0,1)$, the hiring decision $\ell^C\left(z^F, \ell^E\right)$ is increasing in z^F and decreasing in ℓ^E. For low enough values of ℓ^E or high enough values of z^F, the firm hires a positive number of contingent workers, while for high values of ℓ^E or low values of z^F, the firm only hires traditional employees. For a fixed choice of ℓ^E, the cutoff $\hat{z}^F$ such that $\ell^C\left(\hat{z}^F, \ell^E\right)$ is just 0 is given by:

$$\hat{z}^F\left(\ell^E\right) = \frac{\left(\ell^E\right)^{1-\alpha} w^C}{\lambda \alpha} \tag{26}$$

After substituting the solution for $\ell^C\left(z^F, \ell^E\right)$ into (24) and using the cutoff $\hat{z}^F$ to split the integral in (23) based on whether the firm would hire only traditional employees (low TFP shocks) or a combination of worker types (high TFP shocks), the first order condition for ℓ^E becomes:

$$\int_{\underline{z}^F}^{\hat{z}^F\left(\ell^E\right)} \left[w^E - \frac{\alpha z^F}{\left(\ell^E\right)^{1-\alpha}}\right] dG_4\left(z^F \mid z^F_{-1}\right) = \int_{\hat{z}^F\left(\ell^E\right)}^{\overline{z}^F} \left[\frac{w^C}{\lambda} - w^E\right] dG_4\left(z^F \mid z^F_{-1}\right) \tag{27}$$

Equation (27) shows that firms balance the difference between traditional employees' wage and their expected marginal product in case the firm draws a low TFP shock (left hand side), against the difference between the effective wages of contingent workers and traditional employees in the event that they receive a high enough TFP shock to hire contingent workers (right hand side).

4.5 Firms: Labor Adjustment Costs

Adjustment costs for traditional employees impose static and dynamic distortions. In the current period, firms consider the cost of adjusting ℓ^E from its value in the previous period, in addition to considering wages and productivity. The distortion is also dynamic because the hiring decision in the current period will affect the static distortion in the next period.

To see this, it is useful to consider again a model where firms hire both types of labor after observing their TFP shock but with adjustment costs for traditional employment. A firm that had traditional employment ℓ^E_{-1} last period and draws TFP shock z^F solves the following problem:

$$\begin{aligned} \bar{V}^F\left(z^F, \ell^E_{-1}\right) = \max_{\ell^E, \ell^C \geq 0} \; & z^F\left(\ell^E + \lambda \ell^C\right)^\alpha - w^E \ell^E - w^C \ell^C \\ & - \frac{\phi}{2}\frac{\left(\ell^E_{-1} - \ell^E\right)^2}{\ell^E_{-1}} + \beta \mathbb{E}\left[\bar{V}^F\left(z^F_{+1}, \ell^E\right) \mid z^F\right] \end{aligned} \tag{28}$$

where z^F_{+1} is a TFP shock in the following period. Combining the Envelope Condition and the first order conditions, the firm's choice for traditional employees solves the following nonlinear equation:

$$0 = \frac{w^C - \mu^C}{\lambda} - w^E + \underbrace{\phi\left(1 - \frac{\ell^E}{\ell^E_{-1}}\right)}_{\text{static distortion}} \underbrace{- \beta\frac{\phi}{2}\mathbb{E}\left[1 - \left(\frac{\ell^E_{+1}\left(z^F_{+1}, \ell^E\right)}{\ell^E}\right)^2 \middle| z^F\right]}_{\text{dynamic distortion}} \tag{29}$$

where $\mu^C = w^C - \lambda\alpha z^F\left(\ell^E + \lambda\ell^C\right)^{\alpha-1}$ is the multiplier on the contingent worker non-negativity constraint and $\ell^E_{+1}\left(z^F_{+1}, \ell^E\right)$ is the policy function for traditional employment in the next period.

Suppose that a firm draws some high TFP shock, z^F_{high}. Since I am still assuming that $\lambda < \frac{w^C}{w^E}$, if $\phi = 0$ (no adjustment costs), then the firm would not hire any contingent workers and would hire $\bar{\ell}^E(z^F_{high}) = \left(\frac{\alpha z^F_{high}}{w^E}\right)^{\frac{1}{1-\alpha}}$ traditional employees. Further suppose that the firm's traditional employment from the previous period ℓ^E_{-1} is substantially lower than this amount. If $\phi > 0$, then the firm would incur administrative hiring costs to increase its traditional employment to its desired level. Consequently, the firm hires $\ell^E < \bar{\ell}^E(z^F_{high})$ and supplements its total employment by hiring contingent workers.

The exact choice for ℓ^E solves equation (29) with $\mu^C = 0$. This equation balances the effective wage of a contingent worker ($\frac{w^C}{\lambda}$), the marginal cost of a traditional employee in the current period $\left(-w^E + \phi\left(1 - \frac{\ell^E}{\ell^E_{-1}}\right)\right)$, and the expected marginal cost next period of adjusting traditional employment from its current level. The firm then chooses contingent workers $\ell^C = \lambda^{\frac{\alpha}{1-\alpha}} \left(\frac{\alpha z^F_{high}}{w^C}\right)^{\frac{1}{1-\alpha}} - \frac{\ell^E}{\lambda}$. In this case, contingent workers provide flexibility to the firm to increase its total employment level, while spreading the traditional employment adjustment costs across several periods.

Now, consider a firm that draws a low TFP shock, z^F_{low}. Without labor adjustment costs ($\phi = 0$), the firm would choose $\bar{\ell}^E(z^F_{low}) = \left(\frac{\alpha z^F_{low}}{w^E}\right)^{\frac{1}{1-\alpha}}$. If the firm came into the period with a higher level of traditional employment ℓ^E_{-1} and $\phi > 0$, then it would have to pay firing costs to adjust its employment level downward. As a result, it hires $\ell^E > \bar{\ell}^E(z^F_{low})$ traditional employees. Since the employment level is already higher than the ideal level, the firm does not hire any contingent workers. After setting $\ell^C = 0$ and substituting in for the form of μ^C, equation (29) becomes:

$$\alpha z^F_{low} \left(\ell^E\right)^{\alpha - 1} = w^E - \phi\left(1 - \frac{\ell^E}{\ell^E_{-1}}\right) + \beta \frac{\phi}{2} \mathbb{E}\left[1 - \left(\frac{\ell^E_{+1}\left(z^F_{+1}, \ell^E\right)}{\ell^E}\right)^2 \middle| z^F_{low}\right] \tag{30}$$

The hiring choice for traditional employment ℓ^E solves equation (30). It balances the marginal product of traditional employees against the sum of the marginal cost in the current period and the expected marginal cost of adjusting traditional employment next period. Unlike in the first case with high TFP shocks, the ability to flexibly hire contingent workers does not help firms that draw low TFP shocks and are stuck with employment levels that are too high. Due to this asymmetric distortion, firms hire fewer traditional employees in the stationary equilibrium of the economy with labor adjustment costs.

5 Calibration and Estimation

Due to the computationally demanding nature of the model, I calibrate the model by assigning values from the literature to standard parameters whenever possible; Table 3 summarizes these parameter values. I then estimate the remaining parameters using Simulated Method of Moments, as summarized in Table 4.

The model period is one month and I assume the discount factor is consistent with an annual interest rate of 4 percent. The fixed labor supply of traditional employees is $\tilde{n}^E = 1$. I assume that θ is drawn from a truncated Cauchy distribution, which I discretize with a grid of 9 points. The location parameter $x_\theta = 1.14$ and the scale parameter $\gamma_\theta = 0.44$ are estimated within the model to match the mean and standard distribution of the hours distribution for contingent workers.

Each period, individuals receive a productivity shock z whose log follows an AR(1) process with innovations distributed normally:

$$\log(z_{i,t}) = \log(z_{i,t-1}) + \eta_{i,t} \tag{31}$$

$$\eta_{i,t} \sim N(\mu_\eta, \sigma_\eta^2)$$

Table 3: Parameters Set Outside of the Model

Parameter	Description	Value	Source or Target
γ	CRRA utility parameter	2.0	Standard value
ν	Elasticity of labor supply	1.0	Arellano, Bai, and Kehoe (2019)
$\tilde{n}^E$	Fixed hours of traditional employees	1.0	Normalization
β	Discount factor	0.9967	4% annual interest rate
σ_ϵ	Variance of taste shocks	0.01	
p^E, p^C	Job finding probabilities	$0.45, 0.5$	Shimer (2005) & Cohany (1996)
δ^E, δ^C	Job separation probabilities	$0.03, 0.15$	
σ_η	Individuals' productivity, variance	0.08	Birinci and See (2021)
ρ_η	Individuals' productivity, persistence	0.9867	
α	Production function curvature	0.66	Standard value
σ_{z^F}	TFP variance	0.12	Arellano, Bai, and Kehoe (2019)
ρ_{z^F}	TFP persistence	0.965	

Table 4: Parameters Estimated within the Model

Param.	Value	Target	Data	Model
x_θ	1.14	Mean of Contingent Worker Hrs.	38	38
γ_θ	0.44	$\frac{\text{Std.}}{\text{Mean}}$ of Contingent Worker Hrs.	0.45	0.39
λ	0.87	Wage ratio	0.89	0.89
ϕ	5.07	Share of firms with %ΔW-2 in $[-X\%, X\%]$	Undisclosed	

I assume that the average productivity level $\bar{z}$ is 1. I discretize the AR(1) process for individual's productivity shocks using Rouwenhorst's (1995) method and 11 grid points.

Following the literature on discrete choices as in McFadden (1973), I assume that individuals' taste shocks over job types are drawn i.i.d. from the Type 1 extreme value distribution with scale parameter σ_ϵ, which I set to 0.01. For a given state (h, a, z) and type θ, the expectation over unemployed individuals' Stage 1 problem in (3) is given by the log-sum formula:

$$\mathbb{E}_\epsilon\left[V_\theta^{U1}(h,a,z,\epsilon)\right] = \sigma_\epsilon \log\left[\exp\left(\frac{V_\theta^{U2}(h,a,z)}{\sigma_\epsilon}\right) + \sum_{j\in\{E,C\}} \exp\left(\frac{\mathbb{E}_{p^j}\left[V_\theta^{j2}(h,a,z)\right]}{\sigma_\epsilon}\right)\right]$$

where $\mathbb{E}_{p^j}\left[V_\theta^{j2}(h,a,z)\right]$ is the expected value of searching for job type $j \in \{E, C\}$. The expected Stage 1 values for the other job types in problems eq: C Worker Stage 1 through eq: B Worker Stage 1 follow similar forms. The logit choice probability that an unemployed individual chooses a given job type, conditional on their state, takes the following form:

$$P\left(j \mid h, a, z; \theta\right) = \frac{\exp\left(\frac{\mathbb{E}_{p^j}\left[V_\theta^{j2}(h,a,z)\right]}{\sigma_\epsilon}\right)}{\exp\left(\frac{V_\theta^{U2}(h,a,z)}{\sigma_\epsilon}\right) + \sum_{k\in\{E,C\}} \exp\left(\frac{\mathbb{E}_{p^k}\left[V_\theta^{k2}(h,a,z)\right]}{\sigma_\epsilon}\right)}, \qquad j \in \{U, E, C\}$$

I use these formulas to calculate the expected continuation value when solving the contingent worker's problem in (7), the traditional employee's problem in (8), the multi-job holder's problem in (9), and the unemployed individual's Stage 2 problem in (10).

As discussed in Subsection 3.1, firm TFP shocks are persistent and i.i.d. across firms. Now, I further assume that the log of TFP shocks follow an AR(1) process with innovations distributed normally. This process is described as follows:

$$\log\left(z_t^F\right) = \rho_{z^F} \log\left(z_{t-1}^F\right) + \eta_t^F \tag{32}$$

$$\eta_t^F \sim N(\mu_{\eta^F}, \sigma_{\eta^F})$$

I discretize the AR(1) process for $\log\left(z^F\right)$ using Tauchen's (1986) method and 51 grid points[13].

The production function takes the form $f\left(\ell^E, \ell^C\right) = \left(\ell^E + \lambda\ell^C\right)^\alpha$. I set $\alpha = 0.66$, which is a standard value for the labor share. I estimate the relative productivity λ of contingent workers to match the wage gap documented in Subsection 2.2.2. As described before, firms face adjustment costs of $\phi\left(\ell_{-1}^E, \ell^E\right) = \phi\frac{\left(\ell_{-1}^E - \ell^E\right)^2}{2\ell_{-1}^E}$ for traditional employees. I estimate the scale of these adjustment costs ϕ to match the share of firms that adjust their traditional employees between -5% and 5% from one year to the next. Lastly, I set the tax rate τ^π on

[13] I use Tauchen's (1986) method to discretize the AR(1) process for firms' TFP shocks in order to have a fine grid (51 points with bounds 3 standard deviations above and below the unconditional mean) so I can find a reasonable approximation to the stationary distribution of firms. Meanwhile, using a course grid with 11 points for individuals' productivity shocks does not significantly affect the results. Thus, I use Rouwenhorst's (1995) method to discretize this process as Kopecky and Suen (2010) find that this method better matches the conditional and unconditional moments.

Table 5: Untargeted Moments

Description	Source	Data	Model
Unemployment Rate	BLS, Average 2000-2019	6.0%	7.0%
Contingent Share of Workforce	Katz and Krueger (2019)	10.5%	10.3%
$\frac{\text{UI Bill}}{\text{GDP}}$	BEA, Average 2000-2019	0.4%	0.6%
Cont. Share of Wage Bill, Average	Lim, Miller, Risch, and Wilking (2019)	4.3%	6.9%
Share of Firms with Cont. Workers	Lim, Miller, Risch, and Wilking (2019)	25%	75%

profits to be 0.36 as in Bhandari and McGrattan (2021) and choose τ^y so that government expenditures as a share of GDP are consistent with U.S. data from NIPA.

5.1 Model Fit

This subsection examines the model's ability to reproduce the empirical patterns from the data. Table 5 shows moments that are not targeted. The first row shows that the unemployment rate in the stationary distribution of my model matches the average unemployment rate in the U.S. for 2000 through 2019. The share of contingent workers in the workforce is similar to the share than Katz and Krueger (2019) find for the U.S. The ratio of the UI bill to GDP is slightly higher in my model (0.5%) than the U.S. average (0.4%) for the period 2000 through 2019 (using data from the U.S. Bureau of Economic Analysis NIPA tables).

Lastly, the last two rows of 5 give the average share of compensation paid to contingent workers and the share of firms that hire contingent workers (each of these moments are computed among all firms that hire at least one traditional employee). While my model does a good job at matching the average compensation share, a larger share of firms in the model hire contingent workers. This is likely due to the fact that firms are not required to report compensation paid (Form 1099-MISC) to any contingent worker that was paid less than $600 in a given tax year.

5.1.1 Firm Adjustment to Labor

Next, Figure 6 compares how firms adjust their traditional employment and contingent work levels in the model (left panels) to the data (right panels; the data figures are currently under IRS review). The top panels show the distribution of adjustment to each type of labor, relative to the compensation to that labor type from the previous period, as in equation (1). In the model, firms make large adjustments to their compensation to contingent workers (black outlined bars) from one year to the next, with 45 percent of the firm-year observations in the -100 or 200+ percent change bins. In contrast, 45 percent of firms' traditional employee wage bills changed between -10 and 10%. This demonstrates that firms maintain a mass of traditional employees as their core workforce and then use

The bottom panels of Figure 6 show the percent change for each type of labor, relative to the firm's total compensation from the previous year. Most of the total wage bill is paid to traditional employees in the model. As a result, the distributions for traditional employees are very similar in the bottom and top panels. The distributions for changes to contingent worker compensation are much more concentrated near 0 in the bottom panels, with over X percent of firms making less than a 5 percent adjustment (in magnitude) to their compensation to contingent workers.

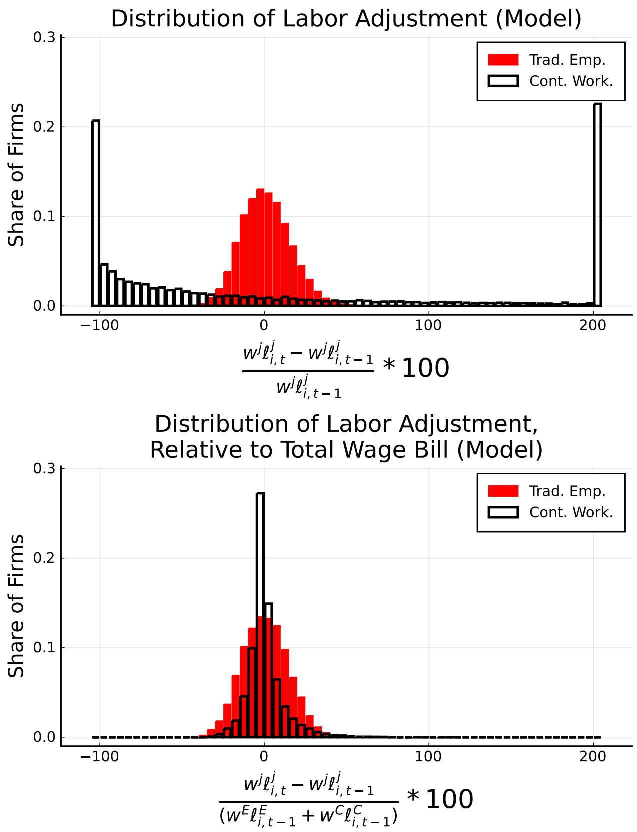

Figure 6: Annual Adjustment to Each Type of Labor by Firms

These figures show the distribution of firms' adjustment to each type of labor (the share of firms in each 5% bin). In the top panels, the adjustment is the annual change in the firm's compensation to a given labor type, relative to the firm's compensation to that type in the previous year, as in equation (1). In the bottom panels, the adjustment is measured relative to the previous year's total labor compensation for the firm, as in equation (**??**). Observations are dropped if the firm did not have any compensation to the given labor type in the previous year. The left panels are results from model simulations (50,000 firm-year observations). The right panels use IRS administrative data (these figures are currently under IRS Disclosure Review).

6 Policy Analysis

I now turn to the main quantitative results. In subsection 6.1, I examine how the availability of contingent work affects the optimal level of UI for traditional employees. In subsection 6.2, I analyze a policy reform that extends UI to contingent workers. For both analyses, I compare the results to the baseline policy that was used for the calibration (and was the prevailing policy in the U.S. from 1935 through early 2020). UI replaces 40 percent of wage income for traditional employees after they lose their job ($b^E = 0.4$) and these benefits last for 6 months on average ($\chi^E = \frac{1}{6}$); contingent workers are not eligible for UI.

6.1 Optimal UI for Traditional Employees

In this subsection, I find the optimal UI replacement rate for traditional employees that maximizes welfare in the steady state of the economy. My welfare criterion is the average expected utility value of individuals, weighted by the share of individuals in each job type and state in the stationary distribution:

$$W(b^E) = \sum_{j \in \{E,C,B\}} \int \mathbb{E}_\epsilon \left[V_\theta^{j1}(a,z,\epsilon)\right] d\Omega^j(\theta,a,z) + \int \mathbb{E}_\epsilon \left[V_\theta^{U1}(h,a,z,\epsilon)\right] d\Omega^j(h,\theta,a,z) \quad (33)$$

Using this welfare measure, I find that the optimal b^E is 0.04, meaning that UI replaces 4% of a traditional employees' income when they become unemployed[14]. Table 6 compares the equilibrium outcomes under this optimal UI policy to those under the baseline policy when $b^E = 0.4$. The benefit duration is 6 months on average in both policies. Comparing columns 1 and 2 shows that lowering b^E increases the incentive for unemployed individuals to search for a job, and so the unemployment rate decreases from 7.0% to 5.1%. Consequently, the

[14]This is similar to the finding in Hansen and Imrohoroğlu (1992) that the optimal replacement rate is 0.05 when individuals are allowed to refuse employment offers (and retain their UI benefits) or to quit (and not be eligible for UI), as is true in my model.

Table 6: Optimal Unemployment Insurance Replacement Rate

	Baseline Policy	Optimal b^E	Optimal b^E, High p^C
Replacement rate b^E	0.40	0.04	0.01
Replacement rate b^C	0.0	0.0	0.0
Benefit duration for employees	6 months	6 months	6 months
Benefit duration for cont. workers	-	-	-
Cont. job finding rate p^C	0.5	0.5	0.9
GDP, relative to baseline	-	+0.68%	+0.15%
Relative wage $\frac{w^C}{w^E}$	0.89	0.89	0.87
Tax rate τ^E	1.71%	0.02%	$< 0.01\%$
Tax rate τ^C	-	-	-
Contingent share of workforce	10.3%	12.7%	20.0%
Unemployment rate	7.0%	5.1%	4.5%
$\frac{\text{UI Bill}}{\text{GDP}}$	0.6%	$< 0.1\%$	$< 0.1\%$

total UI bill decreases and so the required τ^E to fund the program decreases; traditional employees' gains from lower taxes while working are greater than their future losses from lower UI benefits.

I next consider how the availability of contingent jobs affects the optimal UI policy. In section 5, I calibrated the model parameters using data from before 2010. Since that year, websites and apps such as Uber, Upwork, and Fiverr have made it easier for individuals to find contingent work. I model this by increasing the contingent job-finding rate p^C from 0.5 to 0.9. Column 3 of Table 6 shows that this technological change decreases the optimal b^E to 0.01. Now, individuals near the borrowing constraint are able to exit unemployment quickly by finding contingent work. Thus, there is less need for UI benefits because contingent work allows individuals to smooth consumption.

Table 7: Results under Baseline and Extended UI Policies

	Baseline Policy	Extended UI	Extended UI, Short Duration	No UI
Replacement rate b^E	0.4	0.4	0.4	0.0
Replacement rate b^C	0.0	0.4	0.4	0.0
Benefit duration for employees	6 months	6 months	6 months	-
Benefit duration for cont. workers	-	6 months	1 month	-
GDP, relative to baseline	-	-0.22%	-0.10%	$+0.66\%$
Relative wage $\frac{w^C}{w^E}$	0.894	0.902	0.898	0.881
Tax rate τ^E	1.2%	1.2%	1.2%	-
Tax rate τ^C	-	4.9%	2.2%	-
Contingent share of workforce	6.9%	4.4%	5.7%	13.9%
Unemployment rate	6.5%	6.7%	6.6%	5.0%
$\frac{\text{UI Bill}}{\text{GDP}}$	0.8%	0.9%	0.9%	-
Welfare, relative to baseline	-	$\mathbf{-0.01\%}$	$\mathbf{+0.02\%}$	$\mathbf{-0.27\%}$

6.2 Extending UI to Contingent Workers

Between February 2020 and September 2021, the U.S. allowed contingent workers to receive UI benefits through the PUA program in response to the Covid pandemic. In this section, I examine the equilibrium effects of permanently extending UI to contingent workers. This analysis compares steady states under "normal" (non-pandemic) economic conditions. The first policy under consideration extends the same 40 percent replacement rate to contingent workers who become unemployed, and I set the same expiration rate for both types of workers ($\chi^C = \chi^E = \frac{1}{6}$). In a separate policy experiment, I set the expiration probability for contingent workers to be $\chi^C = 1$ so that the duration of their UI benefits is 1 month.

The results of the policy experiment are summarized in Table 7. Comparing the results in columns 1 and 2 shows that extending extending UI to contingent workers (with a benefit duration of 6 months) generates welfare losses of 0.01 percent in consumption-equivalent units.[15] The main reason for these small losses is that the government must tax contingent

[15]The welfare in Table 7 represent the share of lifetime income that newborn individuals (born into

workers' labor income at 4.9 percent in order to fund their UI benefits. These taxes lower contingent workers' net wages. Furthermore, UI lowers the incentives for unemployed, former contingent workers to search for a job while they are receiving the benefits. These two forces together decrease both the extensive share of contingent workers in the labor force (which does not include unemployed, former contingent workers) and the intensive hours decisions of contingent workers. In aggregate, contingent workers supply fewer effective labor hours while slightly more effective hours are supplied in the traditional employment market. This puts upward pressure on the relative wage of contingent workers. Since it is now more expensive for firms to flexibly adjust their production levels, total GDP (and thus aggregate consumption) falls by 0.22 percent. This level decrease in consumption overwhelms the gains from consumption insurance provided by UI, and so the net effect is a decrease to welfare.

Next, I consider a policy that extends the same 40 percent replacement rate to contingent workers, but their benefits only last 1 month before expiring. The UI policy for traditional employees remains the same. Column 3 in Table 7 shows that this policy has a similar but smaller effect on the contingent share of the workforce, the unemployment rate, the relative wage, and GDP as the previous policy did. However, it generates welfare gains of 0.02 percent in consumption-equivalent units. This is because the 1-month duration of UI benefits pushes individuals back to searching for another job. Thus, this policy strikes a balance between disincentivizing job search and providing consumption insurance for contingent workers who lose their job.

To put these changes into context, I also consider a policy without any unemployment insurance. The results are reported in column 4 of Table 7. Without unemployment insurance,

unemployment without UI and with 0 assets) would be willing to give up to have the counterfactual policy.

more individuals choose to search for contingent work in order to get hours flexibility. In addition, the unemployment rate decreases to 5 percent as individuals no longer have an incentive to remain in unemployment. As firms are able to hire more labor hours, GDP (and aggregate consumption) increases by 0.66 percent. Nevertheless, the lack of consumption insurance (except through private savings) dominates and so this policy generates welfare losses of 0.27 percent (which is about 10 times the size of the welfare changes from extending unemployment insurance to both worker types).

7 Conclusion

In this paper, I studied the incentives that drive individuals' choices between traditional employment and contingent work and firms' hiring decisions. I documented greater dispersion and larger changes in hours worked by contingent workers than by traditional employees. In addition, I found that on average contingent workers' annual income is lower by 33 percent, their hourly wages are lower by 11 percent, and their job spells are 11 weeks shorter relative to those of traditional employees.

I developed a structural model where individuals choose to be either contingent workers (so they can flexibly choose hours) or traditional employees (to receive a higher hourly wage). Firms choose how many hours of each labor type to hire. When making this decision, firms take into account 1) the marginal products of traditional employees versus contingent workers relative to their wages, 2) the risk involved in choosing traditional employees before observing their TFP shock and then hiring less productive contingent workers afterward if needed, and 3) administrative costs incurred for adjusting traditional employment from one period to the next. The model generates a similar but slightly lower contingent share of the workforce and a similar wage gap to what I observe in the data. Using this model, I showed that recent technological changes (for example, the development of apps and websites such as Uber) that make contingent work easy to find decreased the optimal UI replacement rate for traditional employees from 0.04 to 0.01. I also showed that extending UI to contingent workers would generate welfare losses of 0.01 percent in consumption-equivalent units if the benefit duration is 6 months (the same as for traditional employees). However, shortening the UI benefit duration to 1 month for contingent workers generates welfare gains of 0.02 percent.

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