Research in Economics 72 (2018) 404–413

Contents lists available at ScienceDirect

Research in Economics

journal homepage: www.elsevier.com/locate/rie

Welfare under friction and uncertainty: General equilibrium evaluation of temporary employment in the U.S.☆

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ARTICLE INFO

Article history:
Received 26 June 2018
Accepted 22 July 2018
Available online 24 July 2018

JEL classification:
E24
C68
J30

Keywords:
Labor market misallocation
Temporary employment
Firing costs
Idiosyncratic uncertainty
General equilibrium
Heterogeneous agents

ABSTRACT

Temporary contracts usually fall outside of employee protection litigation, thus they are often cheaper than permanent contracts and are offered on-demand by firms. In the last two decades, there has been a sharp growth in such contracts in the U.S. labor market. This paper investigates the welfare consequences of offering temporary contracts in the U.S., an environment with low employee protection litigation and high production risk for firms. Employee protection litigation creates firing rigidity in regular labor markets. Pairing firing rigidity with high production risk, firms reduce employment and output, which generates welfare loss. The inexpensive and flexible nature of temporary contracts offers firms a buffer strategy in making employment decisions under risk and navigating the firing rigidity of the regular labor sector, thereby reducing welfare loss. However, temporary contracts cannot fully compensate for the efficiency cost from rising firing rigidity and risk.

1. Introduction

Temporary employment often falls outside of regular employee protection litigation; therefore, hiring temporary workers is usually cheaper and on-demand. Studies evaluating the welfare impact of temporary employment focus on the highly rigid European labor markets. Aguirregabiria and Alonso-Borrego (2014) examine Spanish labor market reform and find that encouraging temporary employment serves as a reduction of firing cost. However, the United States has a far more *laissez faire* market (Lin, 2016; OECD, 2013; Wachter and Estlund, 2012). Understanding the growth of temporary contracts and its welfare impact in the U.S. requires alternative perspectives. This paper uses a general equilibrium framework and extends the literature to the U.S. economy with low labor market rigidity and growing production risk for firms. I find that firms use temporary contracts as a buffer to uncertainty; however, encouraging temporary contracts only moderately alleviates the welfare cost from firing regulations.

Though only a small share of the U.S. labor market, temporary employment has been growing sharply during the last two decades. It exhibits strong cyclicality and leading behavior in recent recessions and recoveries.[1] According to the U.S. De-

☆ I am grateful for Nacy Chau, Sanjay Chugh, Jaroslav Horvath, Pok-Sang Lam, and Bruce Weinberg for helpful comments. This paper benefited from discussions from seminar participants at the Ohio State University, The 81st Annual Meeting of the Midwest Economics Association, Asian Meeting of the Econometric Society in Hong Kong, and China Meeting of the Econometric Society in Wuhan. All remaining errors are my own.

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[1] I document the stylized facts of temporary employment in the U.S. in the Appendix.

https://doi.org/10.1016/j.rie.2018.07.005
1090-9443/

partment of Labor (2015), temporary contracts are designed to last at most one year and/or to respond to a temporary spike in demand. Firms are not obligated to offer the same employment fringe benefits to temporary workers as they are to permanent workers. Moreover, temporary workers are often less productive and are concentrated in low-skilled positions compared to regular workers in the U.S. (Autor and Houseman, 2010; Houseman and Heinrich, 2015; Kilcoyne, 2005; Melchionno, 1999; Peck and Theodore, 2007). With differences in cost and productivity, the extent to which firms are switching between the two employment contract types has important welfare implications.

This paper extends the job turnover framework from Hopenhayn and Rogerson (1993) by separating a regular labor sector that is subjected to firing regulations from a temporary labor sector that operates on firms' demand; the framework is then calibrated to the U.S. data moments. In order to examine firms' response in hiring temporary workers and the welfare impact of this decision, I first introduce a small firing cost to the regular labor sector and then vary the idiosyncratic production risk for firms.[2]

Firing cost generates efficiency loss. Fearing firing expenses, firms hoard excess labor in the event of negative production shock and do not hire according to positive production shock. Once temporary contracts are introduced, firms use them to avoid firing cost, turning further away from hiring regular workers and thereby creating a larger efficiency loss in the regular labor sector. The employment gained through temporary contracts, which are marked by lower levels of productivity, cannot compensate for the efficiency loss from regular sector.

When uncertainty heightens in a market with small rigidity, temporary contracts serve as a buffer strategy. Firms avoid the more frequent needs of labor adjustment and the associated firing cost by sharply increasing temporary contracts. Such a buffer strategy allows firms to reduce misallocation of labor and for households to prevent complete unemployment. However, households still suffer a welfare loss because of the change in labor supply and consumption reduction.

Only a small literature studies temporary employment, and it is largely silent on cases in the U.S. Moreover, there is no consensus on the welfare impact of temporary employment. Partial equilibrium frameworks, such as Aguirregabiria and Alonso-Borrego (2014), argue that increasing temporary employment reduces labor market misallocation, similar to a reduction of firing tax. My study operates in a general equilibrium framework and calibrates to the empirical characteristics of temporary workers in the U.S. I challenge their results by showing that temporary employment does not have the same effect as firing tax reduction in scale. Bentolila and Saint-Paul (1992) and Cabrales and Hopenhayn (1997) acknowledge that temporary employment increases total employment in an economic boom and dampens business cycle fluctuations in aggregate employment. Search models are also frequently used in the literature, with many such studies arguing that temporary employment increases unemployment and has negative welfare consequences (Blanchard and Landier, 2002; Cahuc and Postel-Vinay, 2002). On the other hand, Faccini (2014) introduces the screening motive in utilizing temporary employment and generates a positive welfare consequence. Seliski (2015) and Blanchard and Landier (2002) provide counter-arguments that temporary employment prevents workers from transitioning to high-paid, stable, permanent jobs, which creates a lifetime welfare loss. These studies often exogenously fix the relative ratio of temporary workers to regular workers in the labor force, and they fail to allow endogenous choices to the temporary sector.

2. Model

To explore the impact of fixed-term contracts on the economy, I build a dynamic general equilibrium model with heterogeneous firms and a representative household. The model extends that of Hopenhayn and Rogerson (1993), with a main feature incorporating two labor factors: temporary labor and non-temporary (or permanent/regular) labor.

2.1. Firm's problem

The economy is populated by a continuum of firms with the total mass adding up to one. There is no entry or exit in the economy. The only input to production is the two types of labor, n_1 and n_2, with n_1 being non-temporary regular labor and n_2 being temporary labor. Firms have a CES production function with decreasing returns to scale with the period production function as:

$$f(n_1, n_2) = (\lambda n_1^{\gamma} + (1-\lambda) n_2^{\gamma})^{(\alpha/\gamma)} \tag{1}$$

where λ defines the relative share of temporary employment and γ defines the elasticity of substitution between temporary and permanent labor. Non-temporary employment is an individual endogenous state variable. At the beginning of every period before production, each firm decides to increase, decrease, or maintain the current stock of permanent employees. If a worker is hired to be an non-temporary worker, her contract lasts indefinitely into the future unless she is fired by the firm. Temporary employment, by contrast, is indexed to each period. Firms hire n_2 number of temporary workers at the

[2] Though firing largely "at-will", employers in the U.S. have been subject to firing regulations from the Worker Adjustment and Retraining Notification Act (WARN) since the 1980s (OECD, 2013; Wachter and Estlund, 2012). Despite this flexibility, we still observe a sharp rise in the share of temporary employment (as seen in the Appendix). Labor market rigidity alone cannot explain the use of temporary labor in the U.S. labor market. Empirical documents suggest that firms use temporary employment as a buffer strategy (Schreft and Singh, 2003; Schreft et al., 2005). Firms in particularly volatile environments prefer to hire and fire temporary workers before committing to offering permanent employment. Comin and Philippon (2006) provides empirical background by documenting a continuing increase of idiosyncratic firm-level volatility since the beginning of the Great Moderation.

beginning of each period before production, and their contracts end by the end of the period. The firm needs to hire them again if it needs temporary workers in the next period.

Function 2 models the firing cost. It is an abstract of a variety of rigidity in regular employment compared to temporary employment. Garibaldi and Violante (2005) define firing cost as a combination of transfers between the employer and the laid-off worker and outside of the employer-employee pair as a form of tax. In European labor markets, τ largely represents the level of employment protection legislation (as a firing tax). Though there is little employment protection litigation in the U.S. labor market, there are still many forms of market friction, such as severance pay, unemployment insurance, the cost of emotions in the workforce, the cost of reorganization to a permanent position, etc. The firing cost is modeled as:

$$g(n_1, n_1') = \tau w_1 (n_1 - n_1'), \text{ if } n_1 > n_1' \tag{2}$$

Every period, each firm draws an idiosyncratic productivity shock s before production, and the firm observes s from a standard log-normal AR(1) process before making current period employment decisions.

$$\ln s' = \rho \ln s + \epsilon, \text{ where } \epsilon \sim N(0, \sigma_e) \tag{3}$$

In summary, each firm earns period profit:

$$\Pi = sf(n_1', n_2) - w_1 n_1' - w_2 n_2 - g(n_1, n_1') \tag{4}$$

In a dynamic environment, firms discount future value by factor β_f. We can write firms' problem as:

$$W(s, n_1; \mu) = \max\{W_d(s, n_1; \mu), W_u(s, n_1; \mu)\} \tag{5}$$

The value of a downsizing firm is:

$$\begin{aligned} W_d(s, n_1; \mu) = &\max_{n_1', n_2}\{sf(n_1', n_2) - w_1 n_1' - w_2 n_2 - \tau w_1 (n_1 - n_1') \\ &+ \beta_f E_s W(s', n_1'; \mu')\} \end{aligned} \tag{6}$$

And the value of a firm that is weakly increasing its permanent labor stock is:

$$W_u(s, n_1; \mu) = \max_{n_1', n_2}\{sf(n_1', n_2) - w_1 n_1' - w_2 n_2 + \beta_f E_s W(s', n_1'; \mu')\} \tag{7}$$

From the firm's problem, we can define an individual firm's inter-temporal decision rule as:

$$n_1' = h(s, n_1) \tag{8}$$

And the decision rule for hiring temporary employment:

$$n_2 = \psi(n_1', s, \mu) \tag{9}$$

I track the distribution of firms on the size of non-temporary employment stock, n_1, and the idiosyncratic productivity shock, s, by the probability measure μ generated by the open subsets of the product space, $\mathcal{S} = \mathbb{R}_+ \times \mathbb{R}_+$. Aggregate decision rule μ evolves as:

$$\mu'(s', n_1') = \Gamma(\mu(s, n_1)) \tag{10}$$

In aggregate, non-temporary labor demand has:

$$L_{n_1}^d(\mu') = \int h(s, n_1') d\mu' \tag{11}$$

and temporary labor demand has:

$$L_{n_2}^d(\mu') = \int \psi(s, n_1') d\mu' \tag{12}$$

2.2. Household's problem

The household is endowed with one unit of time deciding to supply temporary jobs and one unit of time in supplying labor to non-temporary jobs. It values utility differently for the time from temporary jobs and non-temporary jobs. The households utility is given by Eq. (13) where c is consumption and $a\log(1 - n_{1t}) + b\log(1 - n_{2t})$ represents utility from leisure. Parameter a and b describe the preference differentials between working at a regular job and at a temporary job. Every period, the household chooses how many hours to allocate to each type of job, and it pools the wages earned from different jobs to enjoy consumption.

$$\log(c_t) + a\log(1 - n_{1t}) + b\log(1 - n_{2t}) \tag{13}$$

The household owns the firms, and hence receives profit rebate Π in addition to government tax rebate Y in a lump sum every period.

Table 1
Benchmark parameter values.

β	λ	γ	α	ρ	σ_e	τ	a	b
0.96	0.961	0.29	0.692	0.9791	0.259	0.6	1	1.1417

Assuming indivisible labor, the household acts as if choosing the share of its members supplying temporary labor and the share supplying permanent labor. We have the household's problem as:

$$\begin{aligned} &U(C, 1-N_1, 1-N_2) = \max_{C,N_1,N_2}\{\log(C) + a\log(1-N_1) + b\log(1-N_2)\} \\ &s.t. \\ &C \leq w_1N_1 + w_2N_2 + \Pi + \Upsilon \end{aligned} \tag{14}$$

2.3. Equilibrium

With the above definitions, the stationary recursive competitive equilibrium is a set of functions for prices, quantities, and values:

$$\{w_1, w_2, r, n'_{1f}, n_{2f}, L^d_{n_1}, L^d_{n_2}, n_{1h}, n_{2h}, N_1, N_2, c, C, Y, W, U\} \tag{15}$$

1. Firms maximize W for Eq. (5) with n'_{1f} and n_{2f} as their associated policy functions.
2. The household maximizes U for Eq. (14) with n_{1h}, n_{2h}, and c as its associated policy functions.
3. Prices w_1, w_2 are competitively determined.
4. The two labor and final good markets are clear.
5. Laws of motion for aggregate state variables are consistent with individual decisions.

Because there is no heterogeneity within the household, its consumption and labor supply decisions can be written as a function of aggregate state: $C(\mu)$, $N_1(\mu)$, and $N_2(\mu)$.

3. Calibration

The model period is one year, consistent with the U.S. Department of Labor (2015) definition of temporary contracts being within one year. However, the leavings and firings of temporary workers with frequencies of less than a year are not accounted for. β equals to 0.96. The idiosyncratic firm productivity follows a Markov Chain with 20 values. I discretize the Markov Chain using Tauchen (1986)'s method. Calibration for the idiosyncratic productivity shock process, as dictated by ρ and σ_e, targets the average firm size distribution as reported by the Longitudinal Business Database from 1977–2013.

While inexpensive and flexible, temporary workers are generally less productive than their permanent counterparts. The majority of temporary workers in the United States are low skilled (Autor and Houseman, 2010; Houseman and Heinrich, 2015; Kilcoyne, 2005). Temporary employees have fewer soft skills, and their employers provide them with fewer training opportunities (Houseman and Heinrich, 2015). Consequently, temporary workers are often paid lower wages than permanent employees, even when their job descriptions are identical. The elasticity of substitution $1/(1-\gamma)$ between temporary and non-temporary labors is approximated as that between low-skilled and high-skilled workers with a value of 1.4 from David et al. (1997). As for the productivity efficiency parameter λ, I match the marginal rate of substitution between the two types of labor to the wage ratio and the average share of temporary employment in the U.S. data. λ is jointly determined with the firing cost τ. The scale of production α is to match the average post-war labor share of output of 0.64. Because firms of different sizes respond to τ differently, changing τ moves the distribution of firms. Firing cost has a close relationship to the job turnover rate. Therefore, the AR(1) parameters (ρ and σ_ϵ), τ, α, and λ, jointly match the said data moments.

Only the ratio of the two disutility parameters in the household's problem matters in this economy. I calibrate a and b to match the wage ratio of about 0.7 (Kilcoyne, 2005). Table 1 reports all of the parameter values calibrated for the study.

Table 2 provides the model-generated values and compares to the calibration targets. The tail end of the firms' size distribution is less ideal in matching; however, given the simplicity of the model, it is within a reasonable range (Hopenhayn and Rogerson, 1993).

4. Analysis

The calibrated model allows for different experiments in studying the causes and consequences of an increase in temporary employment in the US. The two factors under scrutiny include growing labor market rigidity and rising idiosyncratic risk.

Fig. 1 documents the key mechanism that causes labor misallocation. The horizontal axis represents the current level of non-temporary employment, and the vertical axis shows the next period level of non-temporary employment. In an

Table 2
Robustness check.

	Data	Model
Labor share of output	0.64	0.64
Wage ratio	0.7	0.7
Average share of temporary employment	0.02	0.02
Job turnover	0.32	0.30
Firm size distribution		
1–19	0.85	0.82
20–99	0.12	0.12
100–499	0.02	0.03
500–999	0.00	0.00
1000+	0.00	0.02

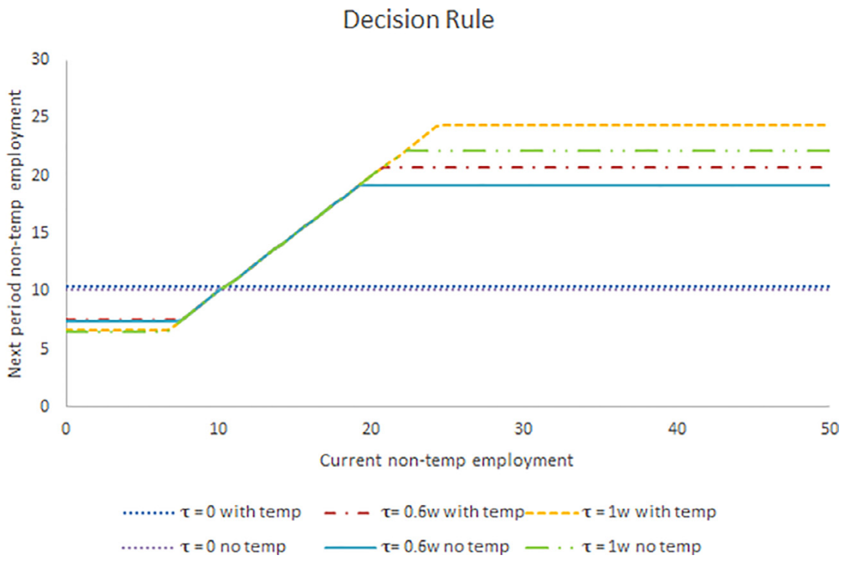

Fig. 1. Decision rule and Inefficiency band.

economy without firing cost, the decision rule is a horizontal line. Firms hiring and firing decisions depend only on the productivity level. With an introduction of a positive τ to the firm's firing decision, the firm has to consider the current stock of employment before deciding how many workers to keep.

The mechanism produces an inverse "Z-shape" inefficiency band. For the current employment level within the upper and lower bounds, the number of employees to keep in the next period relies on the current employment level. Firms no longer adjust perfectly to the level of the productivity shock, thereby generating inefficiency. As we raise the firing cost, the size of the inefficiency band increases. The size of the band positively depends on the variance of idiosyncratic shock and the level of the firing cost.

The size of the inefficiency band expands further in a model with temporary employment. This illustrates the "buffer strategy" used by firms for temporary employment. Firms substitute to less productive but more flexible temporary workers in order to avoid the fixed firing costs.

4.1. Firing cost and temporary employment

Most research treats the share of temporary employment as exogenous. Policy evaluations are conducted through changing the exogenous share parameter. I conduct an experiment by adjusting firing cost only and endogenously generate changes in temporary employment. In particular, I raise the benchmark model firing cost from 7.2 months ($0.6w$) of wage to one year of wage.[3]

Table 3 reports the general equilibrium results of increasing firing cost. Column 1 and Column 3 show the results with zero firing cost and with a firing cost equal to one year of wage rate, respectively. As the firing cost increases, low productivity firms hoard too many workers and high-productivity firms don't hire to their capacity, shown by the decreasing job

[3] According to Wachter and Estlund (2012), the increase of the U.S. labor market regulations in late 1980s caused an increase of labor market rigidity. Indexes show it doubling (OECD, 2013). As a comparison, Garibaldi and Violante (2005) documents that the firing cost in Italy varies between 1.5 years of wage and 3.4 years of wage.

Table 3
Effect of firing cost.

	$\tau = 0$	$\tau = 0.6w$	$\tau = 1w$
Nontemp wage	107.51%	100.00%	97.68%
Temp wage	104.97%	100.00%	98.17%
Wage ratio ($\frac{W_{temp}}{W_{nontemp}}$)	97.64%	100.00%	100.50%
Total nontemp	103.63%	100.00%	99.21%
Total temp	97.94%	100.00%	100.68%
Total employment	103.51%	100.00%	99.24%
Share of temp	94.62%	100.00%	101.45%
Total output	104.99%	100.00%	98.16%
Tax revenue	0.00%	100.00%	127.51%
Total profit	109.29%	100.00%	95.75%
Job destruction rate	183.12%	100.00%	81.85%
Job creation rate	182.96%	100.00%	81.89%
Average firm size	120.81%	100.00%	88.37%
	(1)	(2)	(3)

Note: Column 1 and Column 3 are in comparison to Column 2.

Table 4
With and without temporary employment in the increase of firing cost.

	With temp		Without temp	
	$\tau = 0$	$\tau = 1w$	$\tau = 0$	$\tau = 1w$
Nontemp wage	100.00%	93.02%	100.00%	91.36%
Temp wage	100.00%	95.26%		
Total nontemp	100.00%	96.50%	100.00%	95.78%
Total temp	100.00%	102.10%		
Total employment	100.00%	96.60%	100.00%	95.78%
Total output	100.00%	95.25%	100.00%	93.92%
Total profit	100.00%	91.50%	100.00%	88.42%
Job destruction rate	100.00%	54.61%	100.00%	41.29%
Job creation rate	100.00%	54.66%	100.00%	41.35%
Average firm size	100.00%	82.77%	100.00%	85.19%
Welfare	100.00%	96.51%	100.00%	95.26%
	(1)	(2)	(3)	(4)

Note: Column 2 is in comparison to Column 1; Column 4 is in comparison to Column 3.

destruction rate (JDR) and job creation rate (JCR) across Column 1–Column 3. The average firm size also decreases (from 20% without firing cost to 88% with $\tau = 1$). The inefficiency created by firing cost with no opportunity to exit leads to a large concentration of smaller firms.

In the perfectly efficient model without firing cost, the share of temporary employment is low (92% of Column (2) value). Absent firing costs, firms prefer to hire more productive permanent workers. As the firing cost increases, friction becomes more relevant and the flexibility of temporary labor makes temporary employees more appealing to firms. Though firms reduce the level of employment for both temps and non-temps, the share of non-temporary employment increases from 91.56% of the benchmark level to 102.42% of the benchmark level. This indicates that firms are willing to sacrifice labor productivity by hiring more temporary workers in order to avoiding paying the firing cost. Despite its ability to ameliorate market friction, temporary employment cannot totally eliminate the efficiency loss caused by firing frictions. Output and profit still drop.

I compare the original model (dual-labor model hereafter) to a single-labor economy with only permanent employment to investigate the importance of temporary contracts. The only difference from the benchmark model is that hiring temporary workers is eliminated. Production parameters (essentially α) adjust to make the single-labor economy produce the same level of output as the dual-labor model at $\tau = 0$. Table 4 reports results from the comparison.

After increasing firing cost from $\tau = 0$ to $\tau = 1$, both models lose some labor market activities and output. Increasing the firing cost reduces household welfare, calculated as the level of net utility. Compared to the model without temporary employment, the dual-labor model ameliorates this welfare loss by a about 1.3%. In other words, having a market with temporary employment reduces households' welfare punishment from a high firing cost. Such improvement comes from both a smaller reduction of the output (to 95.25% from 93.92%) and total employment (to 96.6% from 95.7%). In the single-labor model, households can only substitute leisure for permanent labor, as in the illustration of reduction of total employment. But in the dual-labor model, a smaller reduction in total employment represents a small amount of substitution to temporary employment rather than entirely to leisure. With the option of creating temporary jobs to avoid firing cost, JDR and JCR

Table 5
Effect of temporary employment in doubling volatility.

	$\tau = 0$			
	With temp		Without temp	
	$\sigma_e = 0.259$	$\sigma_e = 0.3663$	$\sigma_e = 0.259$	$\sigma_e = 0.3663$
Nontemp wage	100.00%	90.13%	100.00%	88.50%
Temp wage	100.00%	90.14%		
Total nontemp	100.00%	100.00%	100.00%	100.00%
Total temp	100.00%	100.00%		
Total employment	100.00%	100.00%	100.00%	100.00%
Total output	100.00%	90.13%	100.00%	88.51%
Total profit	100.00%	90.14%	100.00%	88.54%
Job destruction rate	100.00%	109.87%	100.00%	109.98%
Job creation rate	100.00%	109.86%	100.00%	109.96%
Average firm size	100.00%	101.83%	100.00%	106.97%
Welfare	100.00%	85.53%	100.00%	83.42%
	(1)	(2)	(3)	(4)
	$\tau = 0.6w$			
	with temp		without temp	
	$\sigma_e = 0.259$	$\sigma_e = 0.3663$	$\sigma_e = 0.259$	$\sigma_e = 0.3663$
Nontemp wage	100.00%	87.83%	100.00%	86.03%
Temp wage	100.00%	89.19%		
Total nontemp	100.00%	97.61%	100.00%	97.09%
Total temp	100.00%	100.83%		
Total employment	100.00%	97.67%	100.00%	97.09%
Total output	100.00%	89.18%	100.00%	87.57%
Total profit	100.00%	90.25%	100.00%	89.27%
Job destruction rate	100.00%	141.16%	100.00%	156.62%
Job creation rate	100.00%	141.08%	100.00%	156.56%
Average firm size	100.00%	112.71%	100.00%	112.21%
Welfare	100.00%	85.66%	100.00%	83.81%
	(5)	(6)	(7)	(8)

Note: Column 2 (6) is in comparison to Column 1 (5); Column 4 (8) is in comparison to Column 3 (7).

decrease less in the dual model (54% than 41%). Table 4 presents evidence that temporary employment provides households a small buffer to the reduction of market activities from firms.

In summary, adding firing cost leads to the misallocation of labor factor, which results in efficiency loss. Firms sacrifice labor productivity by becoming inactive and by hiring more temporary workers to avoid firing cost. An economy with temporary employment reduces welfare loss for households in the event of an increasing firing cost.

4.2. Idiosyncratic risk and temporary employment

Comin and Philippon (2006) utilize an array of indicators to measure idiosyncratic volatility of firms in the last 50 years. They show that idiosyncratic volatility for firms almost doubled during the Great Moderation. In this exercise, I follow their empirical evidence and double the idiosyncratic risk of firms in the benchmark model and compare the response of firms to the availability of temporary employment.

Table 5 presents the comparisons on the effect from having temporary employment under different firing cost regimes and levels of risk. Columns (1)–(4) describe the changes in a frictionless environment. Doubling idiosyncratic volatility directly leads to an increase in job turnover rate (to 109% for both JDR and JCR) in both models, with and without temporary employment.

Columns (5)–(8) introduce firing cost. With the rigidity effect from firing cost, the direction of change in the rise of volatility compounds with the effect of firing cost reallocation. Having temporary employment leads to wage rates reductions of 88% (compared to 86% in a model without temporary employment) for regular workers; total employment decreases of 98% (compared to 97%); total output decreases of 98% (compared to 97%); and welfare decreases of 86% (compared to 84%). Both households and firms are using temporary employment as a buffer strategy against firing cost, uncertainty, and, in the case of households, as an option against decreasing labor market activity. Meanwhile, job turnover rises from 141% to 156%.

In Table 4, the option of having temporary employment increases job turnover when firing cost increases, but the job turnover rate is less responsive to volatility than in the single-labor market. This reflects the dominating effect from the inefficiency band in the regular worker market. As in Fig. 1, an economy with temporary employment has a wider inefficiency band for regular workers because of the intense use of temporary employment as a buffer strategy. In the single-labor model, growing volatility exacerbates job turnover. This is because the heightened production risk urges firms to adjust labor factors more frequently, which dominates the opposite effect from the incentive of fixed-cost avoidance. By allowing for temporary workers in a dual-labor model, however, the motive of fixed-cost avoidance increases, reducing the need for regular workers and the costly changes they incur with turnover.

In short, firms use temporary employment as a buffer strategy. When firing costs and increasing idiosyncratic volatility are compounded, firms show a stronger interest in using temporary workers. Households also benefit by substituting temporary labor for permanent labor in order to mitigate the loss in welfare from large uncertainties in the economy.

5. Conclusion

This paper contributes to the literature of labor market misallocation by examining growing idiosyncratic uncertainty and rising labor market rigidities by introducing temporary employment in a Walrasian framework. A general equilibrium model with heterogeneous firms hiring both temporary and non-temporary workers is calibrated to the U.S. economy. Increasing firing-related cost distorts the allocation of labor factor, and rising idiosyncratic uncertainty amplifies the distortion from firing cost. Firms avoid frequently paying firing cost by not hiring and firing workers based on productivity, thereby creating an inefficiency band in their decision rule. Firms substitute towards temporary workers as a buffer strategy to further avoid frequently paying fixed cost. Thus, the size of the inefficiency band increases with the introduction of temporary employment under friction. Allowing temporary employment cannot recover the efficiency loss from fixed cost and increased uncertainty, and temporary employment does not serve as firing cost reduction. Nevertheless, having temporary employment still alleviates output loss, total employment loss, and households' welfare cost in the event of increasing firing cost and heightened uncertainty.

Appendix A. Stylized facts

There are few studies documenting the stylized facts of temporary employment in the U.S. labor market. Given its small share in the labor force, there is also a lack of systematic and comprehensive aggregate data records for temporary employment. Following Schreft et al. (2005), Schreft and Singh (2003), Melchionno (1999), and Kilcoyne (2005), I use employment data from Personnel Supply Services in the Bureau of Labor Statistics Current Establishment Survey for an approximation of temporary employment from 1972 to 1990, and Temporary Help Services from the Employment Services category for data since 1990. These categories collect data from companies that supply temporary workers to other firms. Such data not only overestimate the temporary employment by counting non-temporary staff members in the service agencies, but also underestimate independent contractors and temporary employees hired directly by each firm. Schreft and Singh (2003) argue that the overestimation should be small; Kilcoyne (2005) argue that temporary help services account for more than 70% of total temporary employment.

It is striking to see the rate of growth of temporary employment in the U.S. Fig. 2 plots the average share of temporary employment using monthly data from 1972 to 2015. It grew from about a quarter percent of total employment in 1972 to about 3% in 2000, and despite large fluctuations in the recent two recessions, it was still over 2.5% in 2015.

I take the natural log of the data and bandpass filtered each series to remove fluctuations higher than 18 months (Christiano and Fitzgerald, 2003). Fig. 3 plots the time series of log-detrended data for temporary employment, non-temporary employment, total employment, and GDP. Given the dominant share of non-temporary employment, it almost replicates total employment. Throughout history, we observe large cyclical fluctuations of temporary employment. Table 6 further documents the volatility and cyclicality of temporary employment to GDP (in comparison to total employment). GDP has a standard deviation of 0.015. Temporary employment is four times as volatile as GDP, while the standard deviation of total employment is only 80% of GDP.

Table 7 documents additional important behavior of temporary employment in recent business cycles. Temporary employment in general leads the change in total employment in both recession and recovery by more than one month. Such leading patterns are becoming more significant in recent recessions, with the increasing share of temporary employment. During the initial job loss and job recovery, temporary employment, despite being only around 2% of total employment, accounts for over 20% of total job loss and up to 55% of total job gain.

Scrutinizing the welfare consequences of temporary employment in the U.S. labor market is important, given its rapid growth, high volatility, and behavior in the businesscycle.

Table 6
Volatility of temporary employment.

	Output	Total Employment	Temporary employment
Std to Output	(0.015)	0.814	4.096
Contemporaneous correlation to output		0.701	0.774
1st order autocorrelation	0.876	0.945	0.932
2nd order autocorrelation	0.693	0.793	0.747

Note: Std to output at the first column is just the standard deviation of output.

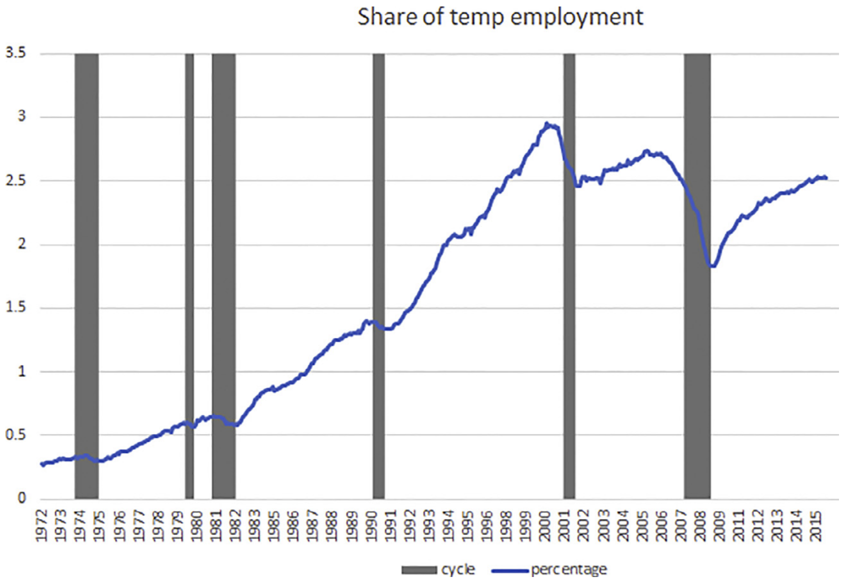

Fig. 2. Share of temporary employment.

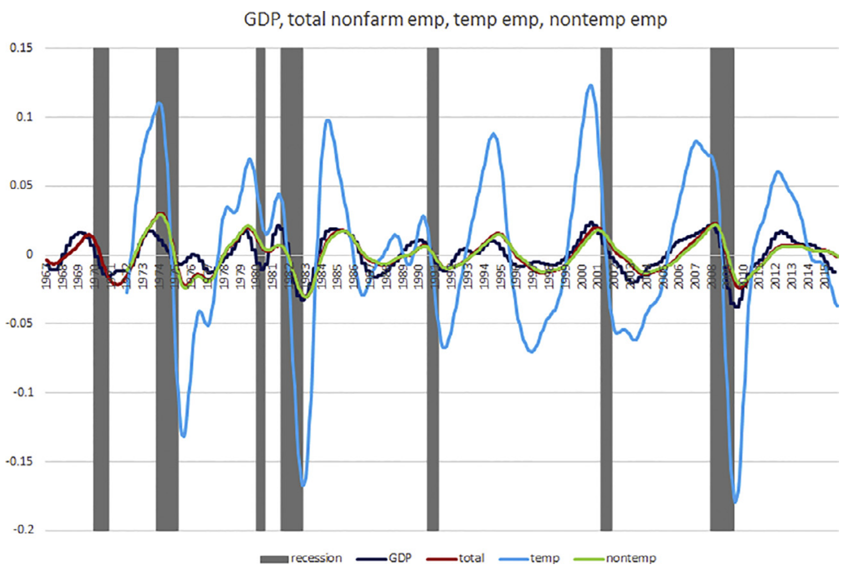

Fig. 3. Business cycle fluctuations.

Table 7
Temporary employment in business cycles.

		1975	1980**	1982	1991	2001***	2009
Recession	Total emp drop	1.62%	1.06%	3.08%	1.14%	1.19%	5.34%
	Total temp drop	12.60%	5.93%	12.84%	5.57%	11.10%	29.71%
	Total drop accounted by temp	2.61%	3.32%	2.38%	6.82%	25.64%	13.73%
	Months before trough total starts to drop	12	11	16	9	10	14
	Months temp preceeds total to drop	1	−1	0	1	5	14
Recovery*	Total gain	6.19%	1.96%	8.11%	1.31%	0.41%	0.71%
	Temp gain	45.41%	15.94%	59.96%	23.41%	7.04%	21.27%
	Total gain accounted by temp	2.19%	4.59%	4.35%	23.84%	42.22%	54.99%
	Months started to recover from trough	5	2	2	7	25	4
	Months temp preceeds total to recover	1	1	2	2	8	3

Note: *recover compares employment level 24 months after trough date to trough level; **1980 recovery compares employment level at June 1981 to trough date; ***2001 recovery compares employment level 30 months after trough date to trough date level.

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