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## Article

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ORIGINAL ARTICLE

Open Access



# Does the effect of employment protection depend on the composition of unemployment?

Andreas Bastgen<sup>1\*</sup>

## Abstract

I develop an equilibrium-matching model with job rationing and endogenous layoffs in order to investigate whether the composition of unemployment (rationing versus frictional) influences the way firing costs affect employment. The model suggests that firing costs lead to a strong adverse employment effect if unemployment is mainly caused by job rationing, whereas in labor markets driven by search frictions firing costs have only a negligible impact on employment. The paper tests this hypothesis using data on the adoption of wrongful-dismissal laws adopted by U.S. state courts during the 1970s and 1980s. Results indicate that for two of the three wrongful-dismissal laws investigated, unemployment composition is crucial for the induced employment effects.

**Keywords** Employment protection, Firing costs, Wrongful-dismissal-laws, Rationing unemployment, Search unemployment, Search-and-matching, Difference-in-difference

**JEL Classification** J64, J65, O31, O38

## 1 Introduction

Beginning in the 1970s, many countries have introduced employment protection laws (EPL). Policy makers typically consider EPL as a way to prevent unjust dismissals and to provide income security to workers (see Clark 2005). Scientists and policy makers are particularly interested in the employment effect of EPL. In standard search models with endogenous layoffs, EPL lowers turnover, while the sign of the employment effect remains ambiguous (see Pissarides 2000). The present paper contributes to the literature by exploring whether the effect of EPL is dependent on the cause of unemployment: search frictions or job rationing.

I do so by leveraging on the job rationing model proposed by Michaillat (2012). In this model rationing unemployment occurs naturally due to diminishing marginal returns to labor and some sort of real wage rigidity. In such an environment, it is possible that the marginal

product of the least productive worker falls short of the real wage, implying that firms would not extend employment beyond this point even in the absence of recruiting costs. Michaillat defines the unemployment level that prevails without search frictions as rationing unemployment.<sup>1</sup>

In the presence of wage rigidities, the marginal value of a worker is decreasing in firing costs.<sup>2</sup> Frictionless employment is determined purely by comparing the wage to the marginal value of a worker. Hence, it decreases in firing costs, which directly implies that rationing unemployment has unambiguously to increase in firing

<sup>1</sup> The term rationing unemployment as defined by Michaillat (2012) should not be confused by mutually binding rationing constraints on the product and labor market as proposed by Keynesian disequilibrium models (see Barro and Grossman 1971).

<sup>2</sup> I use the term “firing costs” and “EPL” interchangeably as the purpose of EPL is to make layoffs costly.

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costs. However, an increase in rationing unemployment also increases total unemployment and thus leads to lower market tightness. Lower market tightness causes lower recruitment costs, which implies that the additional unemployment caused by search frictions has to be smaller. Michaillat (2012) discusses the pro-cyclical<sup>3</sup> behavior of the search component. In the context of EPL, there is a second effect: EPL reduces job destruction rates. Thus, firms need to post fewer vacancies in order to maintain the same employment level over time. This second effect additionally lowers market tightness, recruiting costs and, finally, frictional unemployment.

The theoretical model developed in the next section accordingly shows that frictional unemployment is monotonically decreasing in firing costs. The prediction of my theoretical model is simple: EPL will aggravate the situation, if EPL is introduced in a labor market characterized by heavy rationing. In contrast, if one introduces the same laws in a labor market driven by search frictions, aggregate employment will barely decrease or even increase.

Other theoretical mechanism explaining the employment effect of EPL include for example Pissarides (2001). He gives a possible explanation why there is no clear detrimental effect of EPL on employment. If workers want employment protection as an insurance against income risk, firms do not oppose it, because offering it to their employees, enables firms to reduce the per-unit cost of labor. EPL legislation is needed to reach the optimal level of insurance, because perfect insurance markets cannot develop due to moral hazard. Boeri and Garibaldi (2007) show that in a dynamic labor market model under uncertainty, employment protection may cause a transitional job creating effect, which they call the “honeymoon” effect.

There exists a large literature trying to investigate the effect empirically. Lazear (1990) uses European data to find that severance pay requirements reduce employment. International organizations found a negative impact on the participation rate, but a positive effect on the employment rate for prime age men (see OECD 1994). Several studies have supported the view that EPL can at least be associated with high youth unemployment rates.<sup>4</sup> Despite this emerging consensus, recent studies [e.g. Noeike (2016)] challenge the conventional view. Using OECD data, he finds no robust evidence linking EPL to inferior youth labor market performance. He notes that although there is a strong positive correlation

between regulations on temporary contracts and youth unemployment, country fixed effects completely wipe out this correlation.

Cahuc et al. (2023) document that there exist judge-specific differences on granting compensation for wrongful dismissal. The paper assesses the impact of pro-worker judge bias on several key metrics like job creation, job destruction or employment. Interestingly, the employment effect depends on firm size. It is found to be negative for small and low-performing firms but not significant for the other firms. Several papers also emphasize the possibility that EPL may increase productivity and innovation by giving workers incentives to invest in firm-specific human capital<sup>5</sup> or by inducing a structural shift in the economy.<sup>6</sup>

In order to minimize endogeneity problems, some empirical studies<sup>7</sup> exploit a natural experiment, which has occurred in the United States during the 1970s and 1980s. As the U.S. has a long tradition of employment-at-will, EPL was almost non-existent until the mid-twentieth century. However, beginning in the late 1970s several U.S. state courts began to adopt wrongful-dismissal laws. The most prominent ones are the implied-contract, the public policy and the good-faith exception.

Muhl (2001) provides detailed explanations of all three exceptions. The implied-contract exception states that even if there is no written contract, the employee may have a valid expectation of continued employment based on the supervisor’s statement, an established practice or description of termination processes in the employee handbook. Under the public policy exception, an employee is wrongfully discharged when the termination violates an explicit, well-established public policy of the state. For example, in most states an employer cannot terminate an employee for refusing to break the law at the request of the employer. The good-faith exception is the most significant departure from the traditional employment-at-will doctrine. This exception reads a covenant of good-faith and fair dealing into every employment relationship. Terminations are therefore subject to a “just cause” standard.

Exploiting the variation happening in the 1970s and 1980s Macleod and Nakavachara (2007) argue that the effect of EPL differs between educational groups. They argue that the implied-contract and the good-faith exception raise employment of high skilled workers but have detrimental effects on employment of low skilled

<sup>3</sup> Pro-cyclical here means being positively correlated with the business cycle.

<sup>4</sup> See Esping-Andersen (2000), Heckman and Pages-Serra (2000), Bertola et al. (2007), Kahn (2007), Addison and Teixeira (2003), Botero et al. (2004), Breen (2005), Allard and Lindert (2007), Cahuc et al. (2014).

<sup>5</sup> See Akerlof (1984), Soskice (1997), Zoega and Booth (2003), Belot et al. (2007), Pierre and Scarpetta (2013), Wasmer (2006), Acharya et al. (2014).

<sup>6</sup> Bastgen and Holzner 2017 develop an equilibrium-matching model in which employment protection increases the willingness-to-pay for new ideas and thus shifts economic activity towards more innovation.

<sup>7</sup> See Autor et al. (2006), Autor et al. (2007), Acharya et al. (2014) and Macleod and Nakavachara (2007).

workers. Autor et al. (2006) find significant negative employment effects only for the implied-contract exception, whereas the public policy and the good-faith exception do not significantly alter employment. Moreover, they find that the detrimental effect is more pronounced for production workers. As production workers have a lower level of formal education compared to non-production workers, these findings are in line with Macleod and Nakavachara (2007). Using the same natural experiment Autor et al. (2007) conclude that EPL reduces total factor productivity, while Acharya et al. (2014) note that EPL has the potential to raise innovation.

I broadly follow the empirical approach of Autor et al. (2006) in order to validate my theoretical results. Unluckily, rationing and frictional unemployment are not directly observable. However, my theoretical model suggests that, given matching efficiency, high (low) total unemployment is associated with unemployment being driven by rationing (search frictions). Accordingly, when accepting my theoretical model and assuming that differences in matching efficiency are negligible,<sup>8</sup> pre-treatment unemployment is a valid proxy for the composition of unemployment. This issue is discussed in more detail in chapter 3.5.

Empirical results suggest that the employment effects of the public policy and good-faith exception significantly depend on pre-treatment unemployment. In contrast, pre-treatment unemployment does not significantly influence the way the implied-contract exception impacts employment. A possible explanation for this result could be that firms quickly adapt to the implied-contract exception by updating their recruitment process.<sup>9</sup> In this way, the implied-contract exception acts more as a law, which imposes additional recruiting costs. Correspondingly, the labor market effect of the implied-contract exception may not depend on the composition of unemployment.

I structure the rest of the paper as follows: Section 2 outlines the theoretical model and illustrates its main insights. Section 3 provides some background information on wrongful-dismissal laws, describes the empirical model and discusses the results. Finally, section 4 concludes.

## 2 Theory

### 2.1 Framework

The model is a variant of the classical search-and-matching model in the tradition of Mortensen and Pissarides (1994). It deviates from the basic textbook model by

allowing for large firms, endogenous layoffs and real wage rigidities. The assumption of large firms with diminishing marginal returns combined with real wage rigidities opens up the possibility of rationing unemployment in the sense of Michaillat (2012), whereas endogenous layoffs allow studying the effects of firing costs.

The model is set in continuous time and focuses on steady states.<sup>10</sup> Therefore, the model has a medium-term focus. Although diminishing marginal returns are often associated with short-term models in which one production factor (capital) is fixed, there are several arguments why diminishing marginal returns may also translate into the medium run. These arguments include capital adjustments costs, barriers of entry and liquidity constraints. Diminishing marginal returns may also arise due to heterogeneous worker productivity.

Agents are risk neutral and infinitely lived. Labor is the only factor of production. Households consume the entire production in each period. The model is populated by a unit mass of firms and workers. Each worker supplies one unit of labor. The discount factor is labeled  $\beta$ .

Firms exhibit two different idiosyncratic states: A low productivity state  $L$  in which productivity equals  $\gamma_L$  and a high productivity state  $H$  in which productivity equals  $\gamma_H > \gamma_L$ . I denote the mass of state  $H$  and state  $L$  firms as  $m_H$  and  $m_L$ , respectively. Firm  $i$  production reads  $\gamma_s N_i^\alpha$ , where  $s = \{H, L\}$  indicates the current state of firm  $i$ . As  $\alpha < 1$  firms experience decreasing marginal returns. The transition probability from state  $H$  to state  $L$  is given by  $\delta$ , whereas  $\eta$  denotes the probability of returning to state  $H$ . I call the optimal number of workers employed by firm  $i$  in the high state  $N_i^H$ , whereas  $N_i^L$  denotes the optimal number of workers in the low state.

Laying off workers causes firing costs  $f$  per worker. There is no exogenous rate of job destruction. In order to hire workers firms must post vacancies. If a firm posts a vacancy, it incurs per-period costs  $c$ . Unemployed workers and vacancies are matched using a standard constant returns to scale matching function (see Petrongolo and Pissarides 2001). Market tightness, defined as the ratio of vacant jobs and unemployed workers, is denoted as  $x$ , the worker-finding rate as  $m(x)$ , and the job-finding rate as  $xm(x)$ .

### 2.2 Profit functions and optimality conditions

The following equation governs employment in firm  $i$  over time  $t$ :

<sup>8</sup> This assumption is discussed in detail in Section D in the Appendix.

<sup>9</sup> Such an update may include a careful revision of new employment contracts and policy handbooks to rule out the danger that an implicit contract is established.

<sup>10</sup> The steady state assumption implies that the model cannot be used to assess the economy's behavior in the transition period between one steady state (e.g. low firing costs) and another (e.g. high firing costs). Due to the same reason, the model is not suited to investigate whether EPL amplifies or attenuates temporary shocks (e.g. aggregate technology shock) to the economy.

$$\frac{dN_i}{dt} = m(x)V_i - L_i \quad (1)$$

As there are no aggregate shocks, firm level employment remains constant as long as a firm stays in its productivity state. Moreover, note that there are no exogenous job separations. Together, these two assumptions imply that all firms, which remain in their current state neither post vacancies nor layoff workers. A firm experiencing an adverse transition ( $H \Rightarrow L$ ) choses to layoff  $L_i = N_i^H - N_i^L$  workers, whereas a firm facing a favorable transition ( $L \Rightarrow H$ ) immediately hires  $N_i^H - N_i^L$  workers by posting  $V_i = \frac{N_i^H - N_i^L}{m(x)}$  vacancies. Firms in state  $L$  never have an incentive to post vacancies, whereas firms in state  $H$  never have an incentive to fire a worker.

The following Bellmann equation characterizes the expected profit of firm  $i$  in state  $H$  with workforce  $N_i^H$ :

$$\begin{aligned} \pi_i^H(N_i^H) &= \gamma_H(N_i^H)^\alpha - W^H N_i^H \\ &+ \beta \left[ \delta(\pi_i^L(N_i^H)) + (1 - \delta)\pi_i^H(N_i^H) \right] \end{aligned} \quad (2)$$

Correspondingly, the expected profit of firm  $i$  in state  $L$  with workforce  $N_i^L$  reads:

$$\pi_i^L(N_i^L) = \gamma_L(N_i^L)^\alpha - W^L N_i^L + \beta[(1 - \eta)\pi_i^L(N_i^L) + \eta\pi_i^H(N_i^L)] \quad (3)$$

When determining  $N_i^H$  firms have to take into account that hiring requires posting vacancies. Posting a vacancy causes costs  $c$  per vacancy. Hiring an additional worker requires  $\frac{1}{m(x)}$  vacancies [see Eq. (1)]. Correspondingly, the firm incurs recruiting costs  $\frac{c}{m(x)}$  per worker. A firm entering state  $H$  choses  $N_i^H$  in order to equalize the marginal value of an additional worker with marginal hiring costs:

$$\frac{\partial \pi_i^H(N_i^H)}{\partial N_i^H} = \frac{c}{m(x)} \quad (4)$$

When choosing  $N_i^L$  firms have to take into account that firing a worker causes firing costs  $f$ . Therefore, a firm entering state  $L$  choses  $N_i^L$  in order to equalize the marginal value of laying off an additional worker to marginal firing cost.

$$-\frac{\partial \pi_i^L(N_i^L)}{\partial N_i^L} = f \quad (5)$$

### 2.2.1 Closed form solutions for labor demand

To derive closed form solutions for  $N_i^H$  and  $N_i^L$ , I calculate the marginal value of an additional worker in both states by taking the partial derivative of eqs. (2) and (3)

with respect to  $N_i^H$  and  $N_i^L$  respectively. Combining the marginal values with Eqs. (4) and (5) and rearranging yields:

$$\frac{c}{m(x)} = \alpha \gamma_H(N_i^H)^{\alpha-1} - W^H + \beta \left( -\delta f + (1 - \delta) \frac{c}{m(x)} \right) \quad (6)$$

$$-f = \gamma_L \alpha (N_i^L)^{\alpha-1} - W^L + \beta \left( -(1 - \eta)f + \eta \frac{c}{m(x)} \right) \quad (7)$$

Equations (6) and (7) determine  $N_i^H$  and  $N_i^L$  for given market tightness and wages.

### 2.3 Wage Setting

Michaillat 2012 shows that rationing unemployment arises, when diminishing returns are combined with rigid wages. I closely follow his approach by using the following simple wage schedule determining the wage in state  $s = \{H, L\}$ .

$$W^S = \omega \gamma_S^\mu \quad (8)$$

$\omega$  is a constant and  $\mu$  is the wage elasticity with respect to changes in productivity. I assume  $\mu < 1$  implying that the wage adjusts less than one-to-one to changes in productivity.

Although, a simplistic wage schedule as posted above is only a rough approximation of reality, it captures empirical facts reasonable well. Empirically wages are linked to productivity, but experience a severe amount of rigidity. As long as wages are somewhat rigid, rationing unemployment may occur and the implications of the paper remain valid. This holds independent of the source of the rigidity (for example collective bargaining, minimum wage laws or efficiency wages). Further note that wages do not react to the introduction of employment protection itself (no pass through). However, in the presence of wage rigidity, I consider this an acceptable simplification.

Even with flexible wage bargaining,<sup>11</sup> rationing unemployment may arise, if the value of the outside option  $z$  is larger than the marginal product of labor evaluated at full employment.<sup>12</sup> As many countries maintain generous unemployment benefit schemes, setting  $z$  to a high value compared to productivity is a realistic feature of many labor markets (see Hall 2005). Hence, my results are applicable even in a model with endogenous wages.

<sup>11</sup> Large parts of the literature assume that wages satisfy the Nash bargaining solution with symmetric bargaining weights. In models with large firms the corresponding assumption is intra-firm wage bargaining as proposed by Stole and Zwiebel (1996), which is also known as generalized Nash Bargaining.

<sup>12</sup> Hagedorn and Manovskii (2008) argue that a high outside option value is necessary to explain the large fluctuations in unemployment observed in the data.



Combining the wage-setting schedule with eqs. (6) as well as (7) and rearranging implies:

$$N_i^H(x) = \left( \frac{\alpha \gamma_H}{\frac{c}{m(x)}(1 - \beta(1 - \delta)) + \omega \gamma_H^\mu + \beta \delta f} \right)^{\frac{1}{1-\alpha}} \quad (9)$$

$$N_i^L(x) = \left( \frac{\alpha \gamma_L}{\omega \gamma_L^\mu - (1 - \beta(1 - \eta))f - \eta \beta \frac{c}{m(x)}} \right)^{\frac{1}{1-\alpha}} \quad (10)$$

It is useful to investigate the relationship between firm-level employment and market tightness implied by Eqs. (9) and (10). Market tightness enters the optimality conditions via recruiting costs. Intuitively, higher market tightness lowers the worker-finding rate and thus causes higher recruiting costs  $\frac{c}{m(x)}$ . However, optimal firm-level employment in the two states depends very differently on recruiting costs. Firm-level employment in the high productivity state is decreasing in recruiting costs (and thus in market tightness) as higher recruiting costs require the marginal value of a worker to increase which can only be done by downward adjusting employment. In contrast, firm-level employment in the low productivity state is increasing in recruiting costs. Firms entering the low productivity state chose to layoff less workers if recruiting costs are high in order to save future hiring costs.

Compared to a frictionless labor market in which firms hire (fire) workers until the marginal value of hiring (firing) equals zero, firms in state  $H$  employ less workers, while firms in state  $L$  employ more workers.

## 2.4 Rationing unemployment

Rationing unemployment occurs if total labor demand in absence of recruiting costs falls short of labor supply (unity). This limiting case can easily be analyzed by letting matching efficiency go to infinity<sup>13</sup> or setting vacancy posting costs to zero. By doing so, market tightness drops out of Eqs. (9) and (10). Solving both equations for firm-level employment yields firm-level labor demand schedules  $N_i^{H,R}$  and  $N_i^{L,R}$  occurring in a frictionless labor market:

$$N_i^{H,R} = \left( \frac{\alpha \gamma_H}{\omega \gamma_H^\mu + \beta \delta f} \right)^{\frac{1}{1-\alpha}} \quad (11)$$

$$N_i^{L,R} = \left( \frac{\alpha \gamma_L}{\omega \gamma_L^\mu - (1 - \beta(1 - \eta))f} \right)^{\frac{1}{1-\alpha}} \quad (12)$$

$N_i^{H,R}$  and  $N_i^{L,R}$  depend only on the labor elasticity of output  $\alpha$ , the wage constant  $\omega$  as well as on firing costs  $f$ . Note that  $N_i^{H,R}$  is decreasing in firing costs, while  $N_i^{L,R}$  is increasing. Firms entering the high productivity state hire less workers, because the marginal value of employing a worker is decreasing in firing costs, while firms entering the low productivity state keep more workers in order to save firing costs. To facilitate intuition, solve Eqs. (11) and (12) for the marginal product of labor:

$$\alpha \gamma_H (N_i^{H,R})^{\alpha-1} = \omega \gamma_H^\mu + \beta \delta f \quad (13)$$

$$\alpha \gamma_L (N_i^{L,R})^{\alpha-1} = \omega \gamma_L^\mu - [1 - \beta(1 - \eta)]f \quad (14)$$

Equations (13) and (14) demonstrate that firing costs make it optimal for firms in the high productivity state to choose an employment level which guarantees that the marginal product of labor exceeds the real wage, whereas firms in the low productivity state choose an employment level which yields a marginal product of labor below the real wage. Firing costs reduce the gap between employment levels in both states and therefore reallocate workers to low productive firms.

Note that it is total and not firm-level labor demand what matters for determining rationing unemployment. In the job-rationing model proposed by Michaillat (2012) rationing occurs when the marginal product of labor evaluated at full employment falls short of the real wage. It is not possible to make an analogous statement for the present model, as there is no marginal product of labor for the whole economy, but two different marginal products for each productivity state. Nevertheless, as in the standard model, rationing occurs if the wage compared to marginal productivity (corrected for firing costs) is high. To calculate rationing unemployment it is necessary to calculate aggregate labor demand, which is given by:

$$N^R = m_H N_i^{H,R} + m_L N_i^{L,R} \quad (15)$$

where  $m_H = \frac{\eta}{\eta + \delta}$  and  $m_L = \frac{\delta}{\eta + \delta}$  denote the share of firms in the high-, respectively, low productivity state. Rationing unemployment immediately follows as  $u^R = 1 - N^R$ . It depends not only on firm-level employment in both sectors but also on the (exogenous) distribution of firms across productivity states. Negative values of  $u^R$  indicate that without recruiting costs labor demand would exceed labor supply, that is, there would be a shortage of labor. Allowing for negative values of  $u^R$  is useful to highlight the crucial economic mechanism of the model. In that case, observable unemployment is caused entirely by search frictions.

<sup>13</sup> In this case, vacancies and workers are matched instantaneously. Correspondingly, the worker finding rate  $m(x)$  goes to infinity, which implies that recruiting cost go to zero.

## 2.5 Equilibrium with frictional labor market

If search frictions are present, labor market flows have to be taken into account explicitly. As I restrict attention to stationary equilibria labor market flows must be balanced:

$$qN = xm(x)U \quad (16)$$

where  $U = (1 - (1 - q)N)$  measures the pool of jobless individuals available for hiring.  $U$  is also referred to as beginning-of-period unemployment (see Blanchard and Gali 2010), that is, unemployment before hiring has taken place. In contrast,  $u$  measures within-period unemployment. Rearranging yields a Beveridge curve like expression:

$$N^{SS} = \frac{xm(x)}{q + xm(x)(1 - q)} \quad (17)$$

where  $N^{SS}$  denotes the employment level consistent with balanced labor market flows as a function of the job-finding rate  $xm(x)$  and the job destruction rate  $q$ . In contrast, to the standard search and matching model,  $q$  is endogenous and given by:

$$q = \delta m_H \frac{N_i^H(x) - N_i^L(x)}{N} \quad (18)$$

The second relationship between aggregate employment and market tightness is obtained using firm-level optimality conditions as well as the definition of aggregate employment. The latter reads:

$$N^{FOC} = m_H N_i^H(x) + m_L N_i^L(x) \quad (19)$$

Equilibrium market tightness is determined by the intersection of Eqs. (17) and (19):

$$N^{SS}(x) \stackrel{!}{=} N^{FOC}(x) \quad (20)$$

Section A in the Appendix shows that two potential candidates for equilibrium market tightness  $x^*$  and  $x^{**}$  exist ( $x^{**} > x^*$ ). It also shows that in the high market tightness equilibrium, labor demand is increasing in recruiting costs, which contradicts empirical evidence. In addition, Section B in the Appendix shows that the high market tightness equilibrium is not stable, while the low market tightness equilibrium is. Thus, I focus on the low market tightness equilibrium  $x^*$ .

Given equilibrium market tightness  $x^*$ , firm level employment is given by Eqs. (9) and (10). As  $N = m_H N_i^H + m_L N_i^L$  one can also calculate aggregate employment. Unemployment follows using  $u = 1 - N$ .

The primary goal of the illustrative model is to shape intuition about how frictional and rationing unemployment react to changes in firing costs. First, rationing

unemployment increases in firing costs, if firing costs are reasonably low compared to the wage (see Appendix C for a proof)<sup>14</sup>:

$$f < \omega * \Xi \quad (21)$$

where  $\Xi = \frac{\Theta_A \gamma_L^\mu \gamma_H - \gamma_L \gamma_H^\mu}{\Theta_A \gamma_H (1 - \beta(1 - \eta)) + \gamma_L \beta \delta}$  is an exogenous constant.

Second, frictional unemployment decreases in firing costs if labor demand, for a given market tightness, is decreasing in firing costs (see Appendix C for a proof):

$$\frac{\partial N^{FOC}(x, f)}{\partial f} < 0 \quad (22)$$

This is a very weak assumption, as the only channel through which firing costs positively influence labor demand is via lowering market tightness (as less vacancies are needed for a given level of employment). Correspondingly, I formulate the following proposition:

**Proposition** *If Eqs. (21) and (22) are satisfied, an increase in firing costs causes an increase in rationing unemployment  $u^R$  and a decrease in frictional unemployment  $u - u^R$ .*

To facilitate intuition the models limiting behavior can be investigated. Assume that firing costs are raised to the highest level (denoted as  $f^*$ ) consistent with the plausibility constraint  $N_i^H - N_i^L \geq 0$ . By definition, it holds that  $\lim_{f \rightarrow f^*} (N_i^H - N_i^L) = 0$ . Correspondingly, the job destruction rate  $q$  converges to zero as well. As labor market flows have to be balanced in steady state, the job-finding rate also converges to zero. This is possible only if either market tightness or unemployment converge to zero. Thus, when restricting attention to equilibria with positive unemployment, market tightness converges to zero. Hence,  $\lim_{f \rightarrow f^*} x^* = 0$ , implying  $\lim_{f \rightarrow f^*} (N - N^R) = 0$ , that is, frictional unemployment vanishes when firing costs are raised to its maximum value. The remaining unemployment is due to job rationing.

## 2.6 Equilibrium characterization

As the overall effect of a change in firing costs on employment is ambiguous, the next step is to numerically explore the models reaction to changes in firing costs in different economic regimes.<sup>15</sup> Table 1 contains numerical values for all exogenous variables of the model. Like in Michaillat (2012) the model is calibrated at a weekly

<sup>14</sup> The reason why  $\frac{\partial N^R}{\partial f}$  changes its sign at very high levels of  $f$  is rooted in the convex shape of  $N^{L,R}$ .

<sup>15</sup> A side effect of numerically calibrating the model is the possibility to graphically display the key results of the model, which vastly improves intuition.

**Table 1** Numerical values

Variable		Value	Source/Target
Matching efficiency	$\tau$	0.233	Michaillat (2012)
Discount factor	$\beta$	0.999	Michaillat (2012)
Matching elasticity	$\Psi$	0.700	Shimer (2005)
Vacancy posting costs:	$c$	0.214	Michaillat (2012)
Output elasticity	$\alpha$	0.666	Michaillat (2012)
Firing costs	$f$	0.270	Bartelsmann et al. (2016)
Wage constant	$\omega$	0.625	5.1% Unemployment
Prob. High $\Rightarrow$ Low:	$\delta$	0.020	0.01 Job destruction rate
Prob. Low $\Rightarrow$ High:	$\eta$	0.080	0.325 Vacancy filling rate
Productivity high state	$\gamma_H$	1	Normalization
Productivity low state	$\gamma_L$	0.5	0.6 Market tightness
Wage elasticity	$\mu$	0.151	Shepotylo and Vakhitov (2020)

frequency to fit U.S. data. I use a standard Cobb–Douglas specification of the matching function (see Pissarides and Petrongolo 2001), that is,  $M = \tau U^\Psi V^{1-\Psi}$  where  $\tau$  denotes matching efficiency. Accordingly, the worker-finding rate reads  $m(x) = \tau x^{-\Psi}$  whereas the job-finding rate reads  $xm(x) = \tau x^{1-\Psi}$ .

The baseline calibration consists of the following ten values for exogenous variables: matching efficiency is set to  $\tau = 0.233$ . The discount rate is set to  $\beta = 0.99$ , vacancy posting costs are set to  $c = 0.214$  and the output elasticity of labor is set to  $\alpha = 0.66$  [all values correspond to Michaillat (2012)]. The matching elasticity with respect to unemployment is set to  $\Psi = 0.7$  (see Shimer 2005). Firing costs  $f$  are set to 0.27 reflecting that firing costs in the U.S. roughly equal one month of production (see Bartelsmann, et al. 2016). Finally, the wage elasticity  $\mu$  is set 0.151 (see Shepotylo and Vakhitov 2020).

All former variables are pinned down using direct empirical evidence, while the remaining variables are set to ensure that outcome variables match specific target values. First, the wage constant  $\omega$  is set to 0.625 to target an unemployment rate of about 5.1 %. The transition probabilities between the high and low productivity state are set to  $\delta = 0.02$  and  $\eta = 0.08$  targeting a job destruction rate of around 0.01 as well as a vacancy-filling rate of 0.325 (see Michaillat 2012<sup>16</sup>). Finally, I target market tightness to equal 0.6, which is the average market tightness in the US during the 2001 to 2021 time period (see U.S. Bureau of Labor Statistics 2024). This pins down the productivity shifter to  $\gamma = 0.5$ .

<sup>16</sup> Michaillat (2012) estimates the job destruction and finding rates from the seasonally adjusted monthly series for total separations and hirings in all non-farm industries constructed by the Bureau of Labor Statistics (BLS) from the Job Openings and Labor Turnover Survey (JOLTS) for the December 2000 to June 2009 period.

To illustrate different labor market responses, the model is simulated not only for the baseline value of firing costs, but instead for all  $f \in (0, 2)$ . This range covers the laissez-faire ( $f = 0$ ) equilibrium, the baseline specification ( $f = 0.27$ ) as well as European levels of firing costs ( $f = 1.89$ ).<sup>17</sup>

To investigate whether firing costs impact the labor market differently depending on the initial labor market state, the model is simulated using four different values  $\omega \in [0.6125, 0.625, 0.64, 0.655]$  for the wage constant. As aggregate productivity remains constant, these differences translate into differences in the wage-to-productivity ratio, hence representing four different states of the labor market. With a high real wage, the labor market is sluggish, which is reflected in severe job rationing, whereas search frictions do not play an important role. The opposite is true if the real wage is low: competition for workers is high, which makes search frictions the main driver of unemployment (see Michaillat 2012).

Table 2 shows total, frictional and rationing unemployment in percent for each wage regime either with very high ( $f = 2.0$ ), without ( $f = 0$ ) or with the baseline level of firing costs ( $f = 0.27$ ). For a graphical illustration of all equilibria between  $f = 0$  and  $f = 2$  see Fig. 7 in the Appendix.

If the wage is low ( $\omega = 0.6125$ ), unemployment equals 2.47% before firing costs are introduced. Remarkably, rationing unemployment is highly negative, namely -7.21%. Hence, there would be a shortage of labor in the absence of search frictions. With search frictions, such a shortage never occurs, as market tightness and thus recruiting costs converge to infinity, if unemployment approaches zero. Even if the wage-to-productivity ratio is extremely low, there is always positive unemployment in an economy with search frictions. Correspondingly, search unemployment, measured as the drop in labor demand caused by recruiting cost, equals 9.68%.<sup>18</sup> With increasing firing costs, the expected pattern materializes:

<sup>17</sup> Empirically firing costs range between one (U.S.) and seven months of production (see Bartelsmann et al. 2016). Taking purely mechanically, this translates into values for the firing cost parameter  $f$  ranging from  $f = 3.6$  to  $f = 25.2$  (weekly output in the model is roughly 0.9). However, taken into account the setup of the model this is not sensible. In the model, each separation involves paying firing costs. In reality, two thirds of job separations happen by mutual agreement (for job sorting, life cycle or personal reasons). In addition, half of the remaining separations are due to discontinuing temporary jobs. Only about 15% of all layoffs can be attributed to retrenchments (see D'Arcy et al. 2012). Retrenchments may be either a job closure or a dismissal. If firing costs have to be paid for 50% of all retrenchments (which seems to be a sensible approximation), this implies that only 7.5% of all dismissals are associated with paying firing costs. Considering this implies an empirically plausible range for  $f$  between 0.27 and 1.89, which fits well into the range used in the simulation.

<sup>18</sup> If, for example,  $N^R = 1.02$ , it follows that  $u^R = -0.02$ . With a total unemployment rate of 4% the drop in labor demand (search unemployment) caused by search friction is 6%.



**Table 2** Calibration results

Unemployment	$f=0$	$f=0.27$ (Baseline)	$f=2$	$\Delta$
$\omega = 0.6125$				
Total	2.47	2.57	2.11	- 0.36
Frictional	9.68	7.68	- 0.39	- 10.07
Rationing	- 7.21	- 5.11	2.44	9.65
$\omega = 0.625$				
Total	4.65	5.13	8.12	3.47
Frictional	5.57	4.11	0.04	- 5.53
Rationing	- 0.92	1.02	8.16	9.08
$\omega = 0.64$				
Total	8.15	9.19	14.46	6.01
Frictional	2.14	1.43	0.02	- 2.12
Rationing	6.00	7.76	14.44	8.44
$\omega = 0.655$				
Total	13.03	14.41	20.16	7.13
Frictional	0.733	0.50	0.02	- 0.713
Rationing	12.3	13.91	20.14	7.84

The Table displays total, frictional and rationing unemployment in percent for four different wage regimes and three different levels of firing costs. Source: Own simulations

rationing unemployment picks up, as the cost of employing a worker rises, but remains negative up until about  $f = 1.1$ . Conversely, frictional unemployment monotonically decreases and becomes slightly negative for firing costs higher than  $f = 1.85$ . Total unemployment decreases slightly from 2.47% (at  $f = 0$ ) to 2.11% (at  $f = 2$ ). The near independence of total unemployment from firing costs hides that firing cost massively change the composition of unemployment from being entirely driven by search frictions to being entirely driven by job rationing. This heavily affects the effectiveness of other labor market policies. For example, if policy makers eliminate recruiting cost ( $c = 0$ ) unemployment would completely vanish in the equilibrium without firing cost, while being not affected in the equilibrium with very high firing costs ( $f = 2$ ).

Despite the slight increase in employment, firing costs lower output from 0.914 to 0.90 (see Fig. 9) as more workers are employed in low productive firms. From a welfare point of view, most relevant is net output defined as output minus sunk costs. Recruiting expenditures definitely belong to sunk costs. Firing costs are sunk, if they mainly consist of legal or bureaucracy costs. In contrast, if they consist mainly of a severance payment to workers, they do not belong to sunk costs. I measure net output using both interpretations of firing costs.<sup>19</sup> If firing costs are

interpreted as severance payment, net output decreases only marginally from 0.903 to 0.899 (0.4%), as lower gross output is compensated by lower recruiting expenditures. Naturally, the decrease in net output is somewhat larger if firing cost are considered sunk. In this case net output decreases from 0.903 to 0.889 (1.6%).

Overall EPL performs remarkably well in a labor market with low wage-to-productivity ratio: aggregate employment increases, while all measures of output decrease only slightly. Apparently, in such an environment EPL provides benefits like higher job security and longer employment spells<sup>20</sup> at low costs.

Turning to the high wage labor market ( $\omega = 0.655$ ) reverses this impression. In this scenario, unemployment before introducing firing costs equals 13.03%. With increasing firing costs, unemployment heavily increases and reaches 20.16% at  $f = 2$ . In this economy, search frictions do not matter much: even without firing costs, they cause only 0.73 percentage points of total unemployment. At  $f = 2$ , frictional unemployment is roughly zero. However, as frictional unemployment is low in the first place, the decrease in frictional unemployment is small in total numbers. As rationing unemployment strongly increases (similarly as it does in the low wage setup), EPL has a strong adverse effect on aggregate employment, because due to low market tightness turnover costs are low and thus the marginal utility of reducing turnover is also low (see Fig. 8 in the Appendix).

The negative employment effect directly passes through on output: compared with the low wage equilibrium, gross output decreases far more steeply in firing costs (from 0.85 to 0.79), because lower aggregate employment reinforces the negative effect of decreasing average productivity. Net output defined as output minus recruiting costs very closely resembles the course of output as market tightness and, thus, recruiting expenditures are low for the whole range of firing costs. Correspondingly, savings in recruiting cost caused by lower turnover cannot even closely make up for the loss in gross output. Quantitatively, net output decreases by around 6.7%, when firing costs increase from  $f = 0$  to  $f = 2$ . If firing costs are sunk, the negative effect on net output increases to about 9.1%.

If  $\omega = 0.625$  and  $\omega = 0.64$  outcomes range between the previously discussed results, ensuring that unemployment composition matters in a continuous way when assessing the effects of firing costs.

The observed decrease in search unemployment is key for understanding why the composition of unemployment matters. This decrease occurs, because market

<sup>19</sup> Note that the models equilibrium is unaffected by the specific type of firing costs, as wages follow a fixed schedule.

<sup>20</sup> Note that, although important in reality, these benefits are not explicitly valued in the model.

tightness is monotonically decreasing in firing costs throughout all wage regimes (see Fig. 8 in the Appendix). Appendix C provides a theoretical proof for this relationship. Intuitively, market tightness decreases because firing costs suppress labor turnover, implying that less vacancies are needed for a given level of employment. In most equilibria, a higher level of total unemployment also leads to lower market tightness. Lower market tightness lowers recruiting costs per worker  $\frac{c}{m(x)}$ , which in turn leads to lower frictional unemployment.<sup>21</sup>

### 3 Empirical evidence

#### 3.1 Outline

The empirical analysis in this paper builds on the difference-in-difference approach used by Autor et al. (2006). Currently, they provide the most reliable estimates regarding the employment effect of EPL. Specifically, they measure the effect of wrongful-dismissal laws adopted by U.S. state courts during the 1970s until the 1990s. As heterogeneity between U.S. states is smaller than between countries, the common-trend assumption used in their difference-in-difference<sup>22</sup> identification strategy is more likely to be satisfied compared to a cross-country study. Basically, Autor et al. (2006) argue that the systematic difference in employment over time between adopting and non-adopting states can be attributed to the introduction of wrongful-dismissal laws. Section 3.5.2 discusses the details of their identification strategy. The present paper uses the same dataset,<sup>23</sup> but augments the analysis by taking into account the composition of steady state unemployment before the introduction of EPL.

The theoretical model predicts that EPL has a strong detrimental effect on employment, if rationing causes unemployment, while barely influencing employment if search frictions drive unemployment. If one accepts the theoretical model and assumes a constant matching efficiency<sup>24</sup> across counties (see Sunde and Fahr 2006), rationing unemployment matters most if total unemployment is high. In contrast, search frictions drive unemployment, if total unemployment is low. This leads to the following testable hypothesis:

**Hypothesis 1** The higher the unemployment rate before introducing EPL, the more adverse is the employment effect caused by EPL.

#### 3.2 Wrongful-dismissal laws

The United States have a long tradition of employment at will, that is, both parties (employer and employee) have the right to terminate the employment relationship at any time. However, during the 1970s and 1980s the majority of U.S. state courts adopted one or more common-law exceptions to the employment-at-will doctrine. These wrongful dismissal laws protect workers from being laid-off in different ways. The three distinct wrongful-dismissal laws used in the analysis are (i) the public policy exception, (ii) the good-faith exception and (iii) the implied-contract exception. Figure 1 shows the staged adoption of wrongful-dismissal laws by U.S. state courts over time.

The public policy exception (PP) prohibits firing a worker for an act that is consistent with public policy<sup>25</sup> as well as for refusing an act that is inconsistent with public policy.<sup>26</sup> The public policy exception was widely recognized. By 1999, 43 U.S. states had adopted the policy. However, courts restrict the application of the public policy exception to violations of law instead of violations of public policy in a broader sense. Thus, its direct economic importance is limited.

As suggested by its name, the good-faith exception (GF) requires employers to layoff workers only with just cause. The interpretation of the good-faith exception is vague. Broadly applied, its economic impact could be very far-reaching. It could be used as general device against any layoff that is not due to economic necessity or poor performance. However, courts normally limit the application to timing cases, in which the employer fires a worker just before a large payment (bonus, pension benefits, etc.) is due. In contrast to the public policy exception, the good-faith exception was only adopted by 11 state courts.

The implied-contract exception (IC) rules out layoffs without “just cause” if the employer raises the expectation that it is regular policy of the company to restrict layoffs to situations of just cause.<sup>27</sup> According to U.S. state courts, raising such expectations establishes an implicit contract between the employer and its employees. This is the case, for example, if an internal personnel policy handbook states that it is the company’s policy to not terminate employment relationships without just cause, or if

<sup>21</sup> Except for the case where labor demand is increasing in recruiting costs. These equilibria, however, do not satisfy the equilibrium refinement condition [see Eq. (26)].

<sup>22</sup> Autor et al. (2006) implement the difference-in-difference design by using a two-way fixed effects regression model which includes state- as well as time fixed effects.

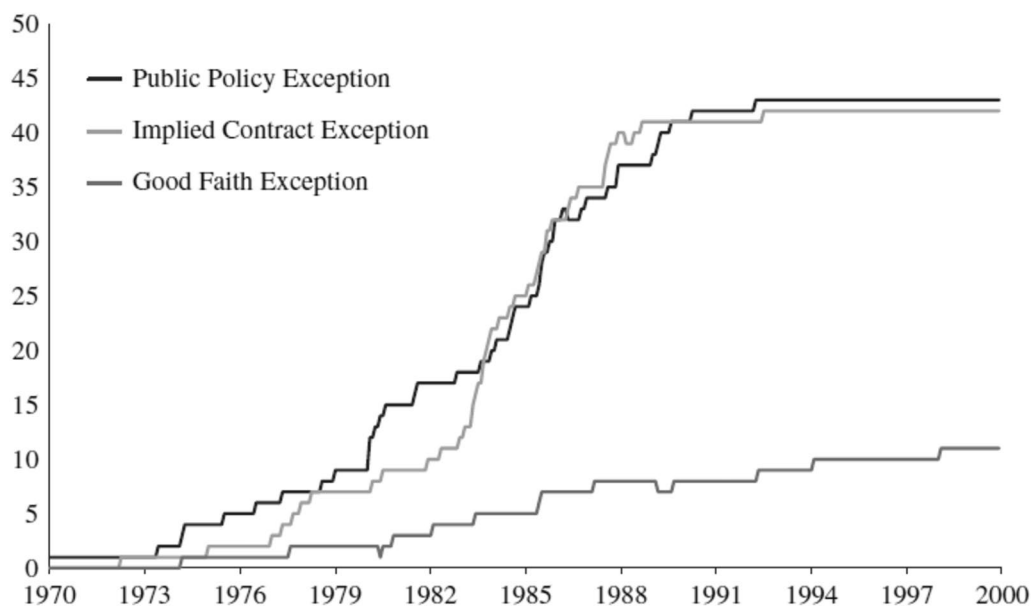
<sup>23</sup> Using the same data increases comparability of our results to those obtained by Autor et al. (2006).

<sup>24</sup> To take into account differences in matching efficiency, state level vacancy data would be necessary. Unfortunately, there is no regional vacancy data available for the relevant period. Section D in the Appendix discusses the potential impact of differences in matching efficiency on my results.

<sup>25</sup> Take a worker who knows that his employer violates safety standards. Laying off a worker, because he reports the information to the inspecting authority violates the public policy exception.

<sup>26</sup> It violates the public policy-exception if the employer fires a worker, because the latter refuses to commit perjury or to conduct industrial spying.

<sup>27</sup> Examples for “just cause” layoffs are redundancies due to business operations or layoffs due to serious misbehavior of the employee.



**Fig. 1** The figure shows the staged adoption of wrongful-dismissal laws by U.S. state courts between the mid-1970s and the mid-1990s. Source: Autor et al. (2006)

the employee has a long history of service or promotion. By 1999, 41 U.S. state courts have adopted the implied-contract exception. Although employers can evade the implied-contract exception by simply checking personnel handbooks, it can be very important, because a judgment based on the implied-contract exception potentially affects a large fraction of an employer's workforce. For a more elaborated discussion of the institutional details, see Autor et al. (2006), Edelman, et al. (1992) and Schwab (1993) (Fig. 1).

### 3.3 Data

The dataset used by Autor et al. (2006) is available on David Autor's webpage.<sup>28</sup> The dataset contains detailed information about when and by which state a particular wrongful-dismissal law was adopted. Note that it is not always completely clear when a particular wrongful-dismissal law was adopted by a certain state. Autor et al. (2006) consider a wrongful-dismissal law as adopted once a major appellate court signals adoption. In particular, this excludes lower court decisions that have been reversed on appeal. To increase the usable variation in the adoption of wrongful dismissal laws (and thus precision of estimation) data is coded at monthly frequency. Most wrongful-dismissal laws were adopted already in the early 1980s, whereas in the 1990s there is only little variation. State level unemployment data is taken from

the Current Population Survey (CPS). The employment-to-population ratio and the unemployment rate are used as outcome variables.

### 3.4 Descriptive evidence

Figure 2 shows the average log employment-to-population ratios for the 48 months before and after the adoption of a specific exception from the employment-at-will doctrine. To shed some light on the raw correlation between the level of pre-treatment unemployment and the employment effect of EPL, the left panels only include adoptions with above average pre-treatment unemployment, whereas the right panels show only adoptions with below average pre-treatment unemployment.

The panels show a general upward trend in the employment-to-population ratio over time. For the implied-contract and good-faith exception there is no clear immediate effect (12 to 24 months) of the adoption in neither the low nor the high pre-treatment unemployment sample. For the good-faith exception, one observes the pattern predicted by theory: for high unemployment states the employment-to-population ratio somewhat falls after adoption, whereas for low unemployment states it tends to increase.

This exercise must not be overinterpreted, as I do not control for any confounding variables. For causal inference, an econometric model is needed, which I develop in the next section.

<sup>28</sup> The full dataset and all corresponding Stata files can be downloaded under <https://economics.mit.edu/people/faculty/david-h-autor/data-archive>.



**Fig. 2** Average employment-to-population ratio before and after adoption for all three exceptions

### 3.5 The empirical model

#### 3.5.1 Regression equation

I adopt the empirical model estimated by Autor et al. (2006) extended by an interaction term between the treatment indicator  $post(i, t)$  and the pre-treatment

average unemployment rate.<sup>29</sup> The latter works as a proxy for steady state unemployment before introduction of the

<sup>29</sup> Note that the main effect of the average pre-treatment unemployment rate is perfectly co-linear with state dummies, as it does not contain any variation over time.



wrongful-dismissal law. When excluding the interaction term, the model reproduces the results of Autor et al. (2006). Formally the model reads:

$$Y_{i,t} = \gamma_s + \gamma_s * treat_{i,t} + \delta_t + Region * Year + \theta_1 * post_{i,t} + \theta_2 (\bar{U}_i * post_{i,t}) + \theta_3 * postpost_{i,t} + \epsilon_{i,t} \quad (23)$$

where  $Y_{i,t}$  is the log of the employment-to-population ratio,  $\delta_t$  represents a full set of time fixed effects, whereas  $\gamma_s$  represents a full set of state fixed effects. *Region* and *Year* are sets of dummy variables representing calendar years and the four major regions of the U.S.

$treat_{i,t}$  equals one for a particular observation, if the observation belongs to the treatment group. Like Autor et al. (2006) I use a five year pre-post interval implying that  $treat_{i,t}$  is one if state  $i$  has adopted the specific wrongful-dismissal law 1–24 month after or 12–36 month before the current date. I exclude observations from the year directly following treatment from the treatment group in order to allow for an adjustment interval just after treatment. The control group contains all observations stemming from states that did not adopt any of the three doctrines during the relevant pre<sup>30</sup>- or post<sup>31</sup>-treatment interval. If there is not a single state that had adopted the doctrine within the relevant time-span around the current date, all observations from that date are dropped. This happens most often, when analyzing the good-faith exception as it was adopted by only 11 states.

In contrast,  $post_{i,t}$  is one only for treatment group observations after, but not before, treatment.  $postpost_{i,t}$  is one for observations belonging to a state that had introduced the particular wrongful-dismissal law more than 36 months ago.

Time dummies absorb variation over time, which is identical across all states, whereas state dummies absorb variation across states, which is constant over time. By using a two-way fixed effects setup, it is possible to control for both time constant heterogeneity across states and nationwide differences across time (e.g. business cycle fluctuations). Additionally, the setup partially absorbs differences in the variation over time: first, the interaction between state dummies and the treatment group indicator allows for systematic differences between treatment and control group states. Thus, the estimated state dummy can be different for the same state depending on whether the state belongs to the treatment group at a certain point in time. Region-by-year dummies control for business cycle differences across the four major U.S. regions. *postpost* dummies capture systematic

differences between control observations stemming from states that were treated in the past and those, which were not.

### 3.5.2 Identification strategy

Pre-treatment unemployment is used to proxy the composition of unemployment. In the theoretical model high (low) pre-treatment unemployment is associated with unemployment being driven by rationing (search frictions). Thus, when accepting the framework of the model it is possible to use pre-treatment unemployment as a proxy for unemployment composition and therefore test the theoretical prediction of the model.

However, note that one can imagine sources of unemployment other than the job rationing mechanism described in the model, which may cause differences in pre-treatment unemployment. As long as those are not correlated to rationing unemployment, total unemployment is still a valid proxy for rationing unemployment. In what follows I interpret my results accordingly.<sup>32</sup>

In order to identify the causal effect of a wrongful-dismissal law, one has to assume that there are no state-specific unobserved temporary shocks, which are correlated with treatment status. Without the interaction term,  $\bar{U}_i * post_{i,t}$ , this assumption is enough to identify the models parameters.<sup>33</sup>

The inclusion of the interaction term, however, creates an additional threat to identification. Estimating Eq. (23) without the interaction term [which corresponds exactly to the specification used in Autor et al. (2006)] reveals that residuals are strongly autocorrelated,<sup>34</sup> which causes the interaction term to be endogenous.

To see this, assume state  $i$  introduces a wrongful-dismissal law in period  $t = \tau$  and let  $\bar{U}_i$  denote the average unemployment rate in the pre-treatment period. As unemployment is strongly correlated with the outcome variable,<sup>35</sup> it follows that  $\bar{U}_i$  is directly correlated with the error terms from all pre-treatment periods, that is,  $\epsilon_{i,\tau-24}$  to  $\epsilon_{i,\tau-1}$ . That alone is not a problem, but as error terms are highly autocorrelated this translates immediately into a significant correlation between  $\bar{U}_i$  and  $\epsilon_{i,t}$  for  $t = \tau + 12$  until  $t = \tau + 36$ . Correspondingly, the interaction term

<sup>30</sup> The pre-treatment period contains the 24 months before treatment.

<sup>31</sup> The post-treatment period contains the time-span 12–36 month after treatment.

<sup>32</sup> Even if pre-treatment unemployment is not interpreted as proxy for unemployment composition, the empirical analysis is still of high value, as it provides evidence that labor markets react differently to the introduction of employment protection depending on labor market states.

<sup>33</sup> If the assumption is violated, estimation would suffer from an omitted variable bias.

<sup>34</sup> Autor et al. (2006) use Huber-White standard errors clustered by state in order to be able to compute consistent standard errors despite the presence of strong serial autocorrelation.

<sup>35</sup> The outcome variable is either the employment-to-population ratio, or the unemployment rate itself.



$\bar{U}_i * post_{i,t}$  is likely to be correlated with the contemporaneous error term potentially causing an endogeneity bias. In general, consistent estimation of an interaction term is possible even if one of the involved regressors is correlated with the error term. Consistency only requires that the correlation between that regressor with the error term does not depend on the other variable involved in the interaction. In my case, the correlation of  $\bar{U}_i$  and the error term is not allowed to depend on  $post_{i,t}$ . However, I do not rely on this assumption but instead use an instrumental variable approach to prevent endogeneity in the first place (see Bun and Harrison 2019).

A valid instrument is correlated with the endogenous variable but not with the error term. This is the case if the instrument affects the outcome variable via the endogenous variable, but is not correlated with any of the omitted variables. To derive such an instrument, I estimate Eq. (23) without the interaction term and with (log) unemployment as the dependent variable (“auxiliary regression”) and collect the fitted values. The fitted values directly translate into estimated values for the level of unemployment, which I then use to construct estimated values for the pre-treatment unemployment rate. The estimated values are by construction uncorrelated with empirical residuals. Given the validity of the identifying assumptions used by Autor et al. (2006) they are also asymptotically<sup>36</sup> uncorrelated with the true error term. This implies that the average pre-treatment unemployment rate constructed from fitted values can be used as an instrument for the actual average pre-treatment unemployment rate. The instrument is valid as it is correlated with the endogenous variable, but uncorrelated with the model’s error term.

In general, using an estimated regressor renders standard errors to be wrong, because estimated regressors only proxy the regressors of interest. However, this is not the case here. Note that asymptotically the predicted value equals the systemic part ( $X\beta$ ) of the actual value, which is exactly the desired instrument. The predicted value is not a proxy for the true value, but it is the actual variable of interest (i.e. the desired instrument). This implies that the variance of the true error term of the auxiliary regression<sup>37</sup> does not matter. A problem would only arise if  $\hat{\beta} \neq \beta$ . In this case, the predicted value would not be exactly equal to the systemic part. However, as  $plim \hat{\beta} = \beta$  this is relevant only in small samples.

### 3.6 Results

I estimate Eq. (23) for all three wrongful-dismissal laws. I choose the employment-to-population ratio and the unemployment rate as dependent variables. In the former case, empirical results confirm the predictions of the theoretical model if the coefficient on the interaction term is significantly negative, whereas in the latter case it should be significantly positive. Table 3 shows all estimated interaction term coefficients as well as the corresponding standard errors. Besides testing the paper’s main hypothesis, the section also evaluates the marginal effect of EPL on the two outcome variables at different values of average pre-treatment unemployment.<sup>38</sup>

#### 3.6.1 Interaction term

First, consider the implied-contract exception. When the employment-to-population ratio is used as dependent variable, point estimates are negative and thus in line with theory. However, the estimated coefficients are not significantly different from zero. The insignificance is particularly striking once regional dummies are included. Turning to unemployment as dependent variable reveals that the point estimate changes its sign depending on whether regional dummies are included or not. Without regional dummies it is positive (and thus in line with theory), while turning negative once regional dummies are included. Overall results suggest that the pre-treatment unemployment rate does not significantly influences the way the implied-contract exception affects the labor market.

Regarding the public policy exception, results draw a different picture. First, all signs are in line with theory regardless whether the employment-to-population ratio or the unemployment rate is chosen as dependent variable. Using the employment-to-population ratio leads to a point estimate for the interaction term coefficient of  $-0.833$  without regional dummies. Regional dummies slightly decrease the absolute value of the estimated coefficient to  $-0.602$ , however, the coefficient remains significant at the 5% confidence level. Economically, these results imply that an increase in the average pre-treatment unemployment rate by 1 percentage point boosts the negative effect of EPL by 0.6 to 0.8 percentage points. Replacing the dependent variable with unemployment reveals that results are remarkably robust: Still the sign of all coefficients are in line with theory, that is, a higher pre-treatment unemployment rate amplifies the positive effect of EPL. Quantitatively, I find that the increase in the unemployment rate caused by the

<sup>36</sup> It is safe to rely on asymptotic arguments as there are at least 7000 observations in any regression performed in the paper.

<sup>37</sup> The true error term of the auxiliary regression captures the differences between predicted and actual value which are not due to differences between the true  $\beta$  and  $\hat{\beta}$ .

<sup>38</sup> Note, that it is necessary to employ the Delta-method to obtain correct standard errors, as the marginal effect consists of a combination between the coefficient on  $post_{i,t}$  and the coefficient on the interaction term. When using the STATA command margins the Delta-method is used by default.

**Table 3** Interaction term results

Dep. variable	Implied-contract	Public policy	Good-faith	Reg
Log (employment-to-population)	− 0.128 (0.180)	− 0.602** (0.308)	− 2.264*** (0.747)	Yes
Log (employment-to-population)	− 0.426 (0.284)	− 0.833** (0.403)	− 2.026*** (0.808)	No
Log (unemployment rate)	− 1.642 (1.823)	4.839* (2.743)	18.789*** (5.642)	Yes
Log (unemployment rate)	0.963 (3.315)	7.042* (3.602)	22.242*** (7.571)	No

The Table displays coefficients on the interaction term between  $post_{i,t}$  and pre-treatment average unemployment  $\bar{U}_i$ . Each coefficient stems from a different regression. Models are weighted by each state's share of national population aged 16–64 (in each month) using CPS sampling weights. Standard errors in parentheses are computed using Huber-White standard errors, which allow for unrestricted error correlation within states

\*\*\*, \*\*, \* indicate statistical significance at the 1%, 5% and 10% confidence level. The column “Region” refers to whether or not region-by-year dummies are included. Region here means one of the four major regions in the U.S

adoption of the public policy exception is between 4.8% (with regional dummies) and 7% (without regional dummies) higher if the pre-treatment average unemployment rate increases by 1 percentage point. Results are significant at the 5% confidence level without regional dummies and at the 10% confidence level with regional dummies.

Results for the good-faith exception provide even stronger evidence in favor of the paper's main proposition: invariably all point estimates are well in line with theory and significant at the 1% confidence level. Correspondingly, the estimated coefficients are larger than in case of the public policy exception. The adverse effect of adopting the good-faith exception on the employment-to-population ratio increases by about two percentage points, for every percentage point increase in the pre-treatment unemployment rate.<sup>39</sup> Similarly, the increase in the unemployment rate due to adoption of the good-faith exception is about 20% higher for every one-percentage point increase in pre-treatment unemployment.

### 3.6.2 Marginal effects

The second measure of interest is the marginal employment effect of introducing a specific wrongful-dismissal law. Table 4 shows marginal effects for all three exceptions using models including a regional dummy. As a robustness check, Tables 5, 6, 7 in Appendix E also show marginal effects without the regional dummy. Results from both specifications are very similar.

In the absence of an interaction term, the marginal effect is simply given by the coefficient on  $post_{i,t}$ , that

is,  $\theta_1$ . With the interaction term the marginal effect reads  $\theta_1 + \theta_2 \bar{U}_i$ . As already pointed out above, it is the sign of  $\theta_2$  that determines whether the marginal effect is increasing or decreasing in average pre-treatment unemployment. Although marginal effects can be directly obtained using the formula stated above, computation of consistent standard errors requires using the Delta method.

In addition to Table 4, Fig. 3a and b visualize how marginal effects depend on pre-treatment unemployment. Figure 3a uses the employment-to-population ratio as dependent variable, whereas Fig 3b uses unemployment as dependent variable. Both figures show point estimates alongside a 95 % confidence interval. The negative slope, present in Fig 3a, reflects the negative sign on the interaction term. With unemployment as dependent variable (Fig 3b), the slope turns positive in case of the public policy and good-faith exception.

I evaluate marginal effects at the mean of pre-treatment unemployment as well as for values two and four units above and below. The figures show that estimated standard errors increase in the absolute distance between the current value of pre-treatment unemployment and its mean. Visually, a broader confidence band reflects this. Thus, given the same point estimate, marginal effects become less significant for more extreme values of pre-treatment unemployment.

*Implied-Contract Exception* Using employment-to-population as dependent variable and pre-treatment unemployment evaluated at its mean, marginal effects approximately coincide with the results from Autor et al. (2006).<sup>40</sup> The small, negative interaction term coefficient implies that the marginal effect is somewhat smaller for

<sup>39</sup> Note that coefficients are higher when the unemployment rate and not the employment-to-population ratio is chosen as dependent variable, because the absolute level of the unemployment rate is far smaller than the absolute level of the employment-to-population-ratio. Thus, the same absolute change gives rise to a far larger percentage change if the unemployment rate is the dependent variable.

<sup>40</sup> Clearly, results do not exactly coincide as the inclusion of an additional regressor (the interaction term) lowers estimation precision leading to somewhat different point estimates.

**Table 4** Marginal effects

Marginal Effect at $\bar{U}_i$ plus						
Dep. variable	Variable	− 4	− 2	0	2	4
Implied-contract-exception						
$\log(\text{employment} - \text{to} - \text{population})$	$\text{post}_{i,t}$	− 1.063 (0.897)	− 1.318** (0.611)	− 1.573*** (0.449)	− 1.828*** (0.539)	− 2.083*** (0.799)
$\log(\text{unemploymentrate})$	$\text{post}_{i,t}$	15.281 (9.497)	11.997* (6.258)	8.714** (3.836)	5.430 (4.109)	2.147 (6.754)
Public policy-exception						
$\log(\text{employment} - \text{to} - \text{population})$	$\text{post}_{i,t}$	2.371** (1.114)	1.166* (0.644)	− 0.039 (0.586)	− 1.243 (1.015)	− 2.448 (1.573)
$\log(\text{unemploymentrate})$	$\text{post}_{i,t}$	− 17.587* (10.087)	− 7.909 (5.680)	1.770 (4.795)	11.448 (8.598)	21.127 (13.604)
Good-faith-exception						
$\log(\text{employment} - \text{to} - \text{population})$	$\text{post}_{i,t}$	8.108*** (2.693)	3.579*** (3.579)	− 0.949 (0.893)	− 5.478*** (2.065)	− 10.007*** (3.492)
$\log(\text{unemploymentrate})$	$\text{post}_{i,t}$	− 67.193*** (19.213)	− 29.615*** (9.153)	7.961 (0.274)	45.538*** (16.640)	83.116*** (27.484)

Models are weighted by state's share of national population aged 16-64 in each month using CPS sampling weights. All models include regional dummies. Standard errors in parentheses are computed using Huber-White standard errors, which allow for unrestricted error correlation within states

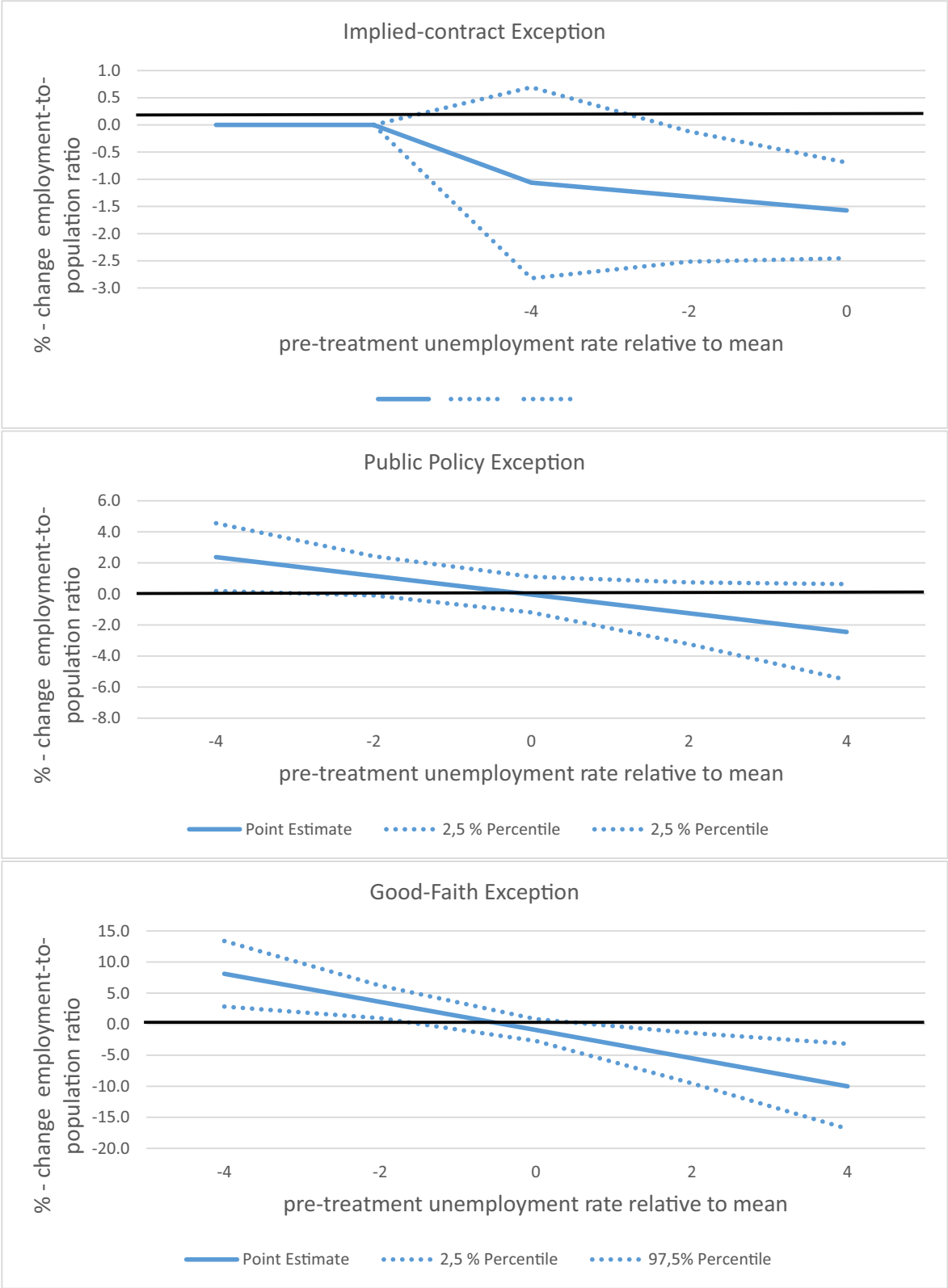
\*\*\*, \*\*, \* indicate statistical significance at the 1%, 5% and 10% confidence level.  $\bar{U}_i$  equals state  $i$ 's average unemployment rate in the 24 month before the introduction of an exception to the employment-at-will doctrine

low values and somewhat larger for high values of pre-treatment unemployment. As standard errors go up when evaluating marginal effects off the mean, marginal effects become insignificant, when evaluated at a very low value of pre-treatment unemployment (four units below its mean). In contrast, if evaluated at a high pre-treatment unemployment rate, marginal effects are large enough to stay significant despite larger estimated standard errors. Turning to unemployment as dependent variable reveals that marginal effects are somewhat less significant. If pre-treatment unemployment is evaluated at its mean, the marginal effect remains significant. However, as the coefficient on the interaction term is very small (compared to the main effect), larger standard errors lead to insignificance once marginal effects are evaluated at high or low values of pre-treatment unemployment.

**Public policy Exception** Again the public policy exception reveals a rather different picture. Marginal effects are highly insignificant when evaluated at the mean of average pre-treatment unemployment. This corresponds to the result of Autor et al. (2006) who do not find any significant effect of the public policy exception. However, marginal effects become significant, when being evaluated at very low or very high values of the moderator. This holds true no matter whether the employment-to-population ratio or the unemployment rate is chosen as

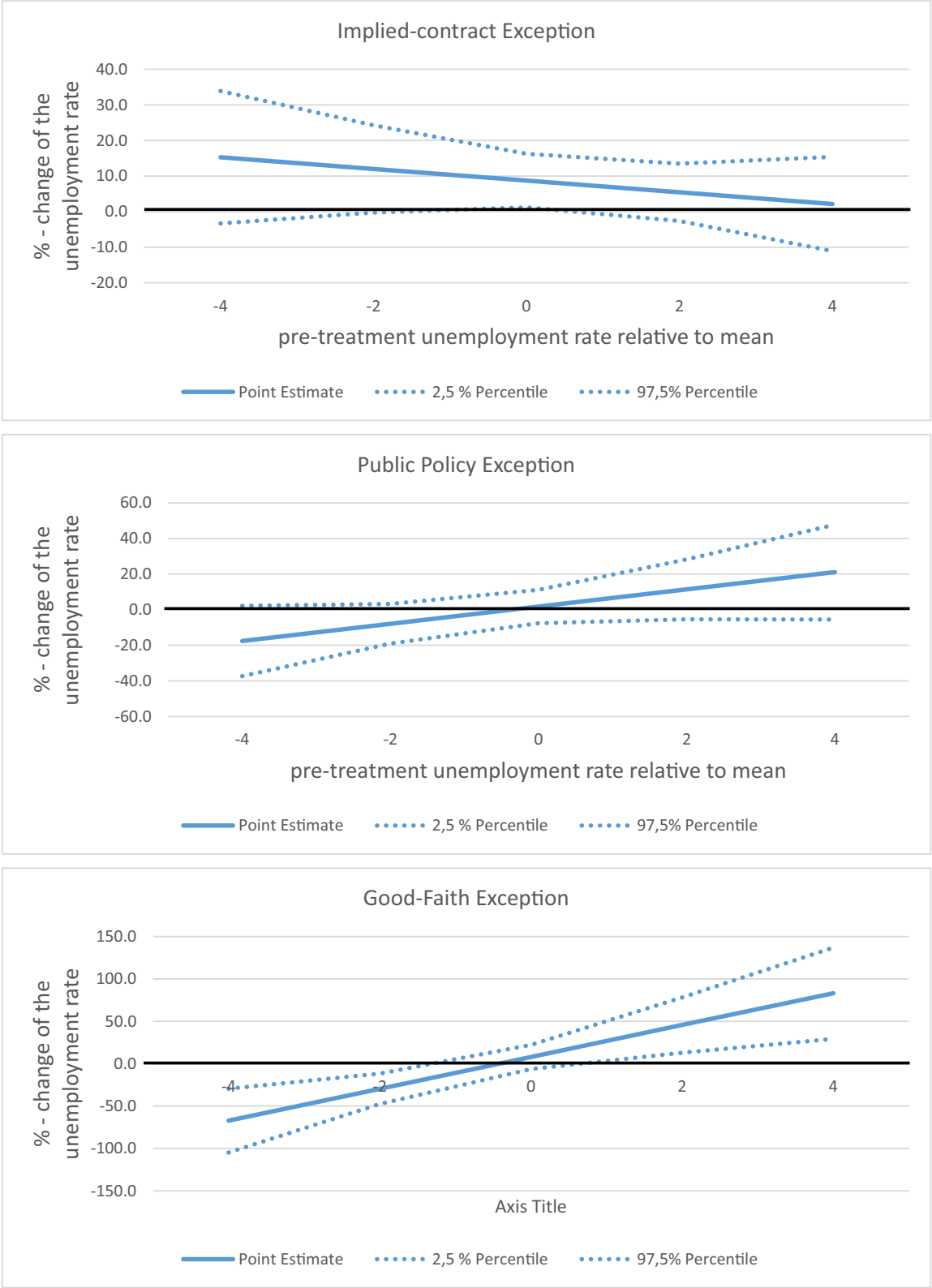
dependent variable.<sup>41</sup> If average pre-treatment unemployment takes on a value two units below its mean, the employment-to-population ratio (the unemployment rate) significantly increases (decreases) after introduction of the public policy exception. This corresponds to the case in which the positive effect of a lower job destruction rate outweighs the negative effect of a lower job-finding rate. Spoken differently, the decrease in frictional unemployment is larger than the increase in rationing unemployment. The story reverses, once the marginal effect is evaluated at a very high value of the moderator (two units above its mean). This case corresponds to a sluggish economy with rationing unemployment contributing the main part to total unemployment. Now, adopting the public policy exception has a detrimental effect on labor market performance. It lowers the employment-to-population ratio and increases the unemployment rate. Significance is somewhat lower compared to the case of a low moderator value, although p-values remain around 0.1, indicating at least weak significance. Note that in both cases estimated standard errors are large, because marginal effects are evaluated far off the mean of average pre-treatment unemployment. Marginal effects clearly reflect the large and significant interaction term coefficient, as discussed above.

<sup>41</sup> Again, significance levels are somewhat higher if the dependent variable is given by the employment-to-population ratio.



a

Fig. 3 a Marginal Effects on the employment-to-population ratio. b: Marginal Effects on the unemployment rate



b

Fig. 3 continued



*Good-Faith Exception* Marginal effects regarding the good-faith exception draw an even more pronounced pattern compared to the public policy exception. They are insignificant when evaluated at the mean of average pre-treatment unemployment, which again corresponds to the result of Autor et al. (2006). When marginal effects are evaluated at a very high or very low level of average pre-treatment unemployment, the large coefficient on the interaction term unfolds its impact: If the moderator is two units below its mean, adopting the public policy exception leads to a significant improvement of labor market conditions. The employment-to-population ratio increases by about 3.5%, whereas the unemployment rate drops by around 30%. In contrast, if average pre-treatment unemployment is two units above its mean, the public policy exception has a strong detrimental effect on both the employment-to-population ratio and the unemployment rate. The effect on the former is around 5.5%, while the effect on the latter is about 45%. Clearly, all coefficients are highly significant (at the 1% confidence level). For more extreme values of the moderator (four units above/below its mean) marginal effects become even larger while remaining strongly significant.

### 3.7 Interpretation

Overall, results draw a mixed picture. Regarding the public policy and the good-faith exception, the analysis provides strong evidence in favor of the paper's main hypothesis.

The estimated coefficients on the interaction term are significant and have the expected sign. Correspondingly, marginal effects behave as expected: the insignificance results reported in Autor et al. (2006) vanish when marginal effects are evaluated at low or high values of average pre-treatment unemployment. The economic message behind these results is clear: although the public policy and the good-faith exception do not affect the employment-to-population ratio and the unemployment rate in a typical U.S. state, they do have strong effects when being introduced in a notably strong or weak labor market. Adopting the public policy or good-faith exception has positive labor markets effects in states with low unemployment, while adverse effects dominate in labor markets with high unemployment. This provides strong evidence for the mechanism proposed in the theory section: EPL lowers frictional unemployment, but increases rationing unemployment. Thus, it has adverse effects in markets driven by job rationing, but favorable effects in markets driven by search frictions. As rationing is likely to occur in sluggish labor markets, EPL widens the gap between strong and weak markets. Many states adopted wrongful-dismissal laws during the 1970s and 1980s. This

may have contributed to the observed sharp rise in U.S. income inequality during the same period.<sup>42</sup>

The results for the public policy and good-faith exception do not translate to the implied-contract exception. Pre-treatment unemployment has no significant impact on the way the implied-contract exception influences the labor market. Instead, the implied-contract exception seems to have detrimental labor market effects in any case (although less significant in labor markets with low pre-treatment unemployment).

There are two possible explanations for the observed pattern: first, the implied-contract exception could be structurally different from the other two wrongful-dismissal laws. This perception is supported by the fact that it is the only wrongful-dismissal law for which Autor et al. (2006) find significant effects on labor market performance. Firms may adapt quickly to the implied-contract exception by updating their recruitment process including a careful revision of new employment contracts and policy handbooks. The complication of the recruitment process may not be limited to the initial adoption, as continuous effort is needed to safely prevent the formation of implicit contracts. In this way, the implied-contract exception actually imposes additional recruiting costs instead of additional firing costs. An increase in recruiting costs unambiguously leads to lower employment/higher unemployment independent of the composition of unemployment. If this mechanism is true, obtained results are well in line with theoretical predictions. Alternatively, insignificance may result from a downward bias caused by omitting differences in matching efficiency (see section D in the Appendix).

## 4 Conclusion

This paper studies the effects of EPL on labor market performance taking into account the composition of unemployment. The paper outlines a stylized equilibrium-matching model, which features diminishing marginal returns to labor and real wage rigidities. The model suggests that EPL unambiguously increases rationing unemployment while having a favorable effect on frictional unemployment. The first effect arises due to a lower marginal value of employing a worker (net of firing costs), while the second effect is caused by lower recruiting costs, which arise due to lower labor market tightness.

Calibrating the model reveals that the overall effect of EPL crucially depends on initial unemployment composition. If search frictions mainly drive unemployment, the positive channel via lower recruiting costs is strong

<sup>42</sup> The Gini-Index for the U.S. rose from about 39 at the beginning of the 1970s to about 45 at the beginning of the 1990s.

enough to offset the negative effect caused by a lower marginal value of employing a worker. In contrast, if rationing unemployment is the main contributor to overall unemployment, the reduction in recruiting costs is only negligible, causing EPL to unfold strong adverse labor market effects.

The empirical part of the paper tests this theoretical prediction using data on the adoption of wrongful-dismissal laws by U.S. state courts. As discussed, I use average pre-treatment unemployment as proxy for the composition of unemployment. I have emphasized that this interpretation requires, amongst others, differences in matching efficiency across states to be negligible. Results confirm theoretical predictions for the public policy and the good-faith exception. In contrast, results regarding the implied-contract exception indicate that unemployment composition does not play a significant role in moderating labor market effects. A possible explanation is that firms adapt to the implied-contract exception, which complicates the recruiting process without actually affecting firing costs.

Overall, theoretical and empirical results indicate that taking into account the composition of unemployment is crucial, when assessing aggregate labor market effects of EPL. Moreover, EPL is likely to act as an amplifier of regional differences in labor market performance.

## Appendix

### A. Equilibrium existence

Equilibrium market tightness is determined by the intersection of Eqs. (16) and (19) that is

$$N^{SS}(x) = N^{FOC}(x) \quad (24)$$

where

$$N^{SS} = \frac{xm(x)}{q + xm(x)(1 - q)} = \frac{1}{\frac{q}{xm(x)} + (1 - q)} \quad (25)$$

First, consider  $N^{SS}$ . Higher market tightness implies a higher job-finding rate  $xm(x)$  and, given  $q$ , a higher value for  $N^{SS}$ . The job destruction rate reads  $q = \delta m_H \frac{N_i^H(x) - N_i^L(x)}{N}$ . As  $N_i^H(x)$  is decreasing and  $N_i^L(x)$  is increasing in market tightness [see Eqs. (9) and (10)], the job destruction rate is decreasing in market tightness. As  $N^{SS}$  is decreasing in the job destruction rate, the positive effect of a higher market tightness on  $N^{SS}$  is reinforced because of the indirect effect via the change of the job destruction rate.

Intuitively, for a given level of employment higher market tightness leads to higher flows out of and lower flows

into unemployment. In order to obtain balanced labor market flows higher market tightness requires higher aggregate employment. Correspondingly, the number of unemployed workers has to be low if market tightness is high.

The sign of the slope of  $N^{FOC}$  is ambiguous, as  $\frac{\partial N_i^H(x)}{\partial x} < 0$  and  $\frac{\partial N_i^L(x)}{\partial x} > 0$ . A necessary and sufficient condition for  $\frac{\partial N^{FOC}(x)}{\partial x} < 0$  is given by

$$\begin{aligned} & f[\gamma_L \beta \delta + \Theta_B \gamma_H (1 - \beta(1 - \eta))] \\ & + \frac{c}{m(x)} [\gamma_L (1 - \beta(1 - \delta)) + \Theta_B \gamma_H \eta \beta] \\ & < (\Theta_B \gamma_H \gamma_L^\mu - \gamma_L \gamma_H^\mu) \omega \end{aligned} \quad (26)$$

where  $\Theta_B = \left( \frac{\frac{\gamma_L}{\gamma_H} (1 - \beta(1 - \delta))}{\delta \beta} \right)^{\frac{1-\alpha}{2-\alpha}} < 1$ .

Thus, for a given set of exogenous variables, there exist a  $\bar{x}$ , so that for each  $x$  smaller (larger)  $\bar{x}$  it holds that  $\frac{\partial N^{FOC}(x)}{\partial x}$  is negative (positive). Moreover, the denominator of Eq. (10) goes to zero if  $x$  becomes large, implying that the slope of  $N^{FOC}(x)$  goes to infinity. Thus, there exist two intersections of the  $N^{FOC}(x)$  curve and the  $N^{SS}(x)$  curve in  $(N, x)$ -space, reflecting two potential candidates for equilibrium market tightness, which I denote as  $x^*$  (low market tightness equilibrium) and  $x^{**}$  (high market tightness equilibrium).

Let me first consider the second equilibrium candidate. As  $x^{**} > \bar{x}$  it holds that  $\frac{\partial N^{FOC}(x)}{\partial x} \Big|_{x=x^{**}} > 0$ . Note that  $\frac{\partial N^{FOC}(x)}{\partial x}$  has always the same sign as  $\frac{\partial N^{FOC}(x)}{\partial \frac{c}{m(x)}}$ , because market tightness only matters for labor demand via recruiting costs. Correspondingly, labor demand in this equilibrium is increasing in recruiting costs, implying that an increase in search frictions (measured by  $c$ ) reduces unemployment. Clearly, such an equilibrium is not compatible with empirical evidence.

Requiring labor demand to be decreasing in recruiting costs is equivalent to imposing an equilibrium refinement condition<sup>43</sup>

<sup>43</sup> The refinement condition is closely related to excluding the case of negative search unemployment. However, it is somewhat stronger as there exist equilibria, which do not satisfy the refinement condition but still exhibit positive search unemployment ( $N^B - N > 0$ ). The intuition behind that goes as follows: search unemployment is being computed as difference in labor demand between an equilibrium with  $c = 0$  and  $c > 0$ , where  $c$  is not infinitesimally small. Thus, the difference between the two equilibria involves a discrete jump (!) in recruiting costs. As the derivative of labor demand with respect to recruiting costs itself depends positively (!) on recruiting costs, a positive derivative does not imply that search unemployment is negative. However, if the derivative is negative one can conclude that search unemployment is positive. Correspondingly, all equilibria satisfying the refinement condition (20) exhibit positive search unemployment.

$$\left. \frac{\partial N^{FOC}(x)}{\partial \frac{c}{m(x)}} \right|_{x=x^{Equilibrium}, c>0} < 0 \quad (27)$$

This also implies that labor demand has to be decreasing in recruiting cost. This allows me to rule out the second equilibrium candidate. Correspondingly, the unique market tightness, which satisfies Eq. (20) and the refinement condition (27), is given by  $x^*$ .<sup>44</sup>

## B. Equilibrium stability

The models steady equilibrium is determined by equating  $N^{SS}(x)$  and  $N^{FOC}(x)$  [see Eq. (20)]. Equation (20) is satisfied by two distinct values of  $x$ , denoted as  $x^*$  and  $x^{**}$ . The equilibrium characterized by  $x^{**}$  is ruled out in the main text, as it requires unemployment to be locally decreasing in recruiting costs. In this section, I augment this argument by showing that the equilibrium associated with  $x^{**}$  is not stable, while the equilibrium associated with  $x^*$  is. As a full-blown out of steady-state analysis under rational expectations is not feasible, I use a simplified, yet intuitive, graphical analysis, which relies on the assumption that firms behave according to (8) and (9) even if market tightness is off its steady state value. Put differently, I assume that firms expect market tightness to remain constant at any given point in time.

Figure 4 shows the adjustment process resulting from a (small) deviation from the low market tightness equilibrium denoted by  $x^*$  in the main text. First, note that the  $N^{FOC}$  curve is downward sloping (in an environment around  $x^*$ ) as  $\left. \frac{\partial N^{FOC}(x)}{\partial x} \right|_{x=x^*} < 0$ . If  $x = x' < x^*$  and  $N$  is below the  $N^{FOC}$ -line, firms find it optimal to hire workers until  $N = N^{FOC}(x')$ . However, the new employment level can only be sustained, if firms continuously hire many workers from a small pool of unemployed. Correspondingly the  $N^{SS}$ -line indicates a high level of market tightness  $x'' > x^*$ . Firms react to the increase in market tightness by reducing employment to  $N = N^{FOC}(x'')$ , which again leads to a decrease in steady state market tightness. However, as long as the negative slope of the  $N^{FOC}$ -line is smaller in absolute value than the positive slope of the  $N^{SS}$ -line this decrease does not fully offset the initial increase in market tightness. Hence, after one adjustment step market tightness is in between  $x_0$  and  $x^*$ . The same process repeats itself until  $x^*$  is reached, that is, the low market tightness equilibrium  $x^*$  is stable. If the slope of  $N^{FOC}$  evaluated at  $x = x^*$  is larger in absolute

value than the slope of  $N^{SS}$  evaluated at  $x = x^*$ , the adjustment process would not fully converge. In this case, the economy oscillates around  $x = x^*$ . However, as  $N^{FOC}$  becomes flatter (and eventually upward sloping) when  $x$  increases the magnitude of the oscillation process is bounded. Hence, a divergent behavior is not possible. Consequentially, analyzing the equilibrium associated with  $x^*$  is meaningful in any case.

In contrast, Fig. 5 shows that the high market tightness equilibrium  $x^{**}$  is not stable (knife-edge equilibrium). If market tightness is slightly below  $x^{**}$  (for example at  $x_0$ , see point A) firms will downward adjust employment to  $N^{FOC}(x')$ . To maintain the lower level of employment firms continuously hire less workers from a larger pool of unemployed, leading to lower market tightness as indicated by the  $N^{SS}$ -line. As  $N^{FOC}(x)$  is upward sloping around  $x = x''$ , firms react to lower market tightness by reducing employment, leading to an even lower market tightness. The economy diverges away from  $x^{**}$ . Analogous arguments hold true, if market tightness is slightly above  $x^{**}$ . In fact, the high market tightness equilibrium turns out to be a modeling artifact and is not of any economic importance. Neglecting it does not harm the generality of my analysis.

## C. Proof of the main proposition

- (i) Condition for rationing unemployment being increasing in firing costs

Labor demand in absence of search frictions in state  $H$  and  $L$  is given by:

$$N_i^{H,R} = \left( \frac{\alpha \gamma_H}{\omega \gamma_H^\mu + \beta \delta f} \right)^{\frac{1}{1-\alpha}} = \left( \frac{\omega \gamma_H^\mu + \beta \delta f}{\alpha \gamma_H} \right)^{\frac{1}{\alpha-1}} \quad (28)$$

$$\begin{aligned} N_i^{L,R} &= \left( \frac{\alpha \gamma_L}{\omega \gamma_L^\mu - (1 - \beta(1 - \eta))f} \right)^{\frac{1}{1-\alpha}} \\ &= \left( \frac{\omega \gamma_L^\mu - (1 - \beta(1 - \eta))f}{\alpha \gamma_L} \right)^{\frac{1}{\alpha-1}} \end{aligned} \quad (29)$$

Note that total labor demand (without search frictions) equals

$$N^{R,FOC} = m_H N_i^{H,R} + m_L N_i^{L,R} = \frac{\eta}{\eta + \delta} N_i^{H,R} + \frac{\delta}{\eta + \delta} N_i^{L,R} \quad (30)$$

Plugging the expressions for  $N_i^{H,R}$  and  $N_i^{L,R}$  into Eq. (30) and taking the derivative with respect to  $f$  yields:

<sup>44</sup> Even if one does not require Eq. (27) to be satisfied it can be shown numerically that (for reasonable parameter values)  $x^{**}$  violates the plausibility constraint  $N_i^H \geq N_i^L$  independent of the level of firing cost or the wage regime.

$$\frac{\partial N^{R,FOC}}{\partial f} = \frac{1}{\alpha - 1} \left[ \left( \frac{\omega \gamma_H^\mu + \beta \delta f}{\alpha \gamma_H} \right)^{\frac{2-\alpha}{\alpha-1}} \frac{\eta \beta \delta}{\alpha \gamma_H} - \left( \frac{\omega \gamma_L^\mu - (1 - \beta(1 - \eta))f}{\alpha \gamma_L} \right)^{\frac{2-\alpha}{\alpha-1}} \frac{f(1 - \beta(1 - \eta))}{\alpha \gamma_L} \right] \quad (31)$$

Therefore  $\frac{\partial N^{R,FOC}}{\partial f} < 0$  is equivalent to

$$\frac{\omega \gamma_H^\mu + \beta \delta f}{\gamma_H} - \frac{\omega \gamma_L^\mu - (1 - \beta(1 - \eta))f}{\gamma_L} \Theta_A < 0 \quad (32)$$

where  $\Theta_A = \left( \frac{\eta \beta \gamma_L}{1 - \beta(1 - \eta)} \right)^{\frac{1-\alpha}{2-\alpha}}$ .

Simply rearranging terms yields Eq. (21).

- (ii) Condition for frictional unemployment being decreasing in firing costs

The frictional component measures the drop in labor demand caused by recruiting cost i.e.  $N^R - N$ . Under the refinement condition [see Eq. (27)] the frictional component is always positive and increases in recruiting costs and therefore in market tightness. Hence, showing that higher firing costs lead to lower frictional unemployment boils down to showing that higher firing costs lead to lower market tightness. To do so rewrite Eq. (24) as:

$$G(x, f) = xm(x) - N^{FOC}(x, f) * (q(x, f) + xm(x)(1 - q(x, f))) \quad (33)$$

The implicit function theorem implies that  $\frac{dx^*}{df} = -\frac{\frac{\partial G(x, f)}{\partial f}}{\frac{\partial G(x, f)}{\partial x}}$ , that is, market tightness is decreasing in firing costs if  $G_x$  and  $G_f$  have the same sign. Correspondingly, the next step is to compute the partial derivatives. It holds that:

$$\begin{aligned} G_x &= (xm(x))' \left( 1 - N^{FOC}(x, f) \right) \\ &\quad - \frac{\partial N^{FOC}(x, f)}{\partial x} [q(x, f) + xm(x)(1 - q(x, f))] \\ &\quad - N^{FOC}(x, f) [(1 - xm(x)) \frac{\partial q(x, f)}{\partial x} \\ &\quad - (xm(x))' q(x, f)] \\ &= (xm(x))' \left( 1 - N^{FOC}(x, f) \right) - (1 - xm(x)) \delta m_H \\ &\quad \left( \frac{\partial N_i^H(x, f)}{\partial x} - \frac{\partial N_i^L(x, f)}{\partial x} \right) \\ &\quad + N^{FOC}(x, f) (xm(x))' q(x, f) - \frac{\partial N^{FOC}}{\partial x} xm(x) \end{aligned} \quad (34)$$

$$\begin{aligned} G_f &= - \frac{\partial N^{FOC}(x, f)}{\partial f} [q(x, f) + xm(x)(1 - q(x, f))] \\ &\quad - (1 - m(x)) N^{FOC}(x, f) \frac{\partial q(x, f)}{\partial f} \\ &= - \frac{\partial N^{FOC}(x, f)}{\partial f} xm(x) \\ &\quad - (1 - xm(x)) \delta m_H \left( \frac{\partial N_i^H(x, f)}{\partial f} - \frac{\partial N_i^L(x, f)}{\partial f} \right) \end{aligned} \quad (35)$$

Given the refinement condition [see Eq. (27)],  $G_x$  is always positive.<sup>45</sup> Thus, market tightness is decreasing in firing costs, if  $G_f > 0$ , which is the case if  $\frac{\partial N^{FOC}(x, f)}{\partial f} < 0$ .

Therefore assuming  $\frac{\partial N^{FOC}(x, f)}{\partial f} < 0$  [Eq. (22)] is enough to guarantee that frictional unemployment decreases in firing costs.<sup>46</sup>

#### D. The role of matching efficiency

In the main text average pre-treatment unemployment proxies the steady state composition of unemployment before treatment. Relatively high unemployment is associated with a large (small) share of rationing (search) unemployment, if matching efficiency is constant across observations. As no data on matching efficiency is available, it is necessary to assume that matching efficiency does not vary across states. This section analyzes how a violation of this assumption might change results. If matching efficiency in reality varies across states, estimation potentially suffers from an omitted variable bias. Luckily, it is possible to determine the sign of the resulting bias. Once matching efficiency is available, one can compute average pre-treatment matching efficiency  $\bar{\tau}_i$  for every state and append Eq. (23) by an additional interaction term  $\bar{\tau}_i * post_{i,t}$ . If matching efficiency is high, the share of frictional unemployment is low for a given unemployment rate. Correspondingly, the theoretical model

<sup>45</sup> Note that  $\frac{\partial N_i^H(x, f)}{\partial f} - \frac{\partial N_i^L(x, f)}{\partial f} < 0$ .

<sup>46</sup>  $\frac{\partial N^{FOC}(x, f)}{\partial f} < 0$  is equivalent to  $f[\gamma_L \beta \delta + \Theta_A \gamma_H (1 - \beta(1 - \eta))] + \frac{c}{m(x)} [\gamma_L (1 - \beta(1 - \delta)) + \Theta_A \gamma_L^\mu \eta \beta] < (\Theta_A \gamma_L^\mu \gamma_H - \gamma_L \gamma_H^\mu) \omega$ , where  $\Theta_A$  is already known from equation Fehler! Verweisquelle konnte nicht gefunden werden.. The condition looks very similar to Eq. 26, which I already have assumed to be satisfied (refinement condition). However, as  $\Theta_A < \Theta_B$  the condition is somewhat harder to satisfy than Eq. (26). Thus, the refinement condition does not automatically imply  $G_f > 0$ . Note that the difference between  $\frac{\partial N^{FOC}(x, f)}{\partial f} < 0$  and the refinement condition (26) is quantitatively negligible. The difference is entirely due to the difference between  $\Theta_A$  and  $\Theta_B$ . Independent of any other parameter values,  $\Theta_A = \Theta_B$  if the discount factor  $\beta$  is set to unity. For reasonable values of  $\beta$  (for example  $\beta = 0.999$ )  $\Theta_A$  is only marginally smaller than  $\Theta_B$ . Correspondingly, assuming  $\frac{\partial N^{FOC}(x, f)}{\partial f} < 0$  is only a very small additional assumption once the refinement condition (see Eq. (27)) is accepted (see Fig. 6).

implies that in this case the employment effect of EPL should be more adverse. Put differently, the expected sign of the coefficient on  $\bar{\tau}_i * post_{i,t}$  is negative.<sup>47</sup> Remember also, that theory implies that the coefficient on  $\bar{U}_i * post_{i,t}$  should be negative as well. At the same time, observations with high pre-treatment average matching efficiency, on average, should have low levels of pre-treatment unemployment. Hence  $\bar{\tau}_i * post_{i,t}$ , and  $\bar{U}_i * post_{i,t}$  are likely to be negatively correlated.

Consider an observation with high pre-treatment unemployment rate. This observation is likely to have low pre-treatment matching efficiency. The latter causes the employment effect of EPL to be rather favorable. Correspondingly, omitting  $\bar{\tau}_i * post_{i,t}$  causes

the coefficient on  $\bar{U}_i * post_{i,t}$  to be less negative compared to a model that includes  $\bar{\tau}_i * post_{i,t}$ . Hence, differences in matching efficiency bias the estimated coefficient on  $\bar{U}_i * post_{i,t}$  towards zero. Therefore, differences in matching efficiency cannot cause false significance. Accordingly, including matching efficiency is very unlikely to change conclusions in case of the public policy and good-faith exception. In contrast, taking into account differences in matching efficiency is likely to strengthen the presented empirical evidence. In addition, the bias may provide an alternative explanation for the lack of significance when evaluating the implied-contract exception.<sup>48</sup>

See Tables 5, 6, 7

**Table 5** Implied-contract exception

Marginal effect at $\bar{U}_i$ plus								
Dep. variable	Variable	Coefficient	− 4	− 2	0	2	4	Region
log(employment – to – population)	$post_{i,t}$	− 1.573*** (0.449)	− 1.063 (0.897)	− 1.318** (0.611)	− 1.573*** (0.449)	− 1.828*** (0.539)	− 2.083*** (0.799)	Yes
	$post_{i,t} * \bar{U}_i$	− 0.128 (0.180)						
log(employment – to – population)	$post_{i,t}$	− 1.639*** (0.565)	0.066 (1.200)	− 0.787 (0.746)	− 1.639*** (0.565)	− 2.492*** (0.852)	− 3.344** (1.333)	No
	$post_{i,t} * \bar{U}_i$	− 0.426 (0.284)						
log(unemploymentrate)	$post_{i,t}$	8.714** (3.839)	15.281 (9.497)	11.997* (6.258)	8.714** (3.836)	5.430 (4.109)	2.147 (6.754)	Yes
	$post_{i,t} * \bar{U}_i$	− 1.642 (1.823)						
log(unemploymentrate)	$post_{i,t}$	10.303* (6.077)	6.452 (16.008)	8.377 (10.131)	10.303* (6.077)	12.229 (7.690)	14.155 (13.011)	No
	$post_{i,t} * \bar{U}_i$	0.963 (3.315)						

Models are weighted by state's share of national population aged 16–64 in each month using CPS sampling weights. Standard errors in parentheses are computed using Huber-White standard errors, which allow for unrestricted error correlation within states

\*\*\*, \*\*, \* indicate statistical significance at the 1%, 5% and 10% confidence level.  $\bar{U}_i$  equals state  $i$ 's average unemployment rate in the 24 month before the introduction of the implied-contract exception

<sup>47</sup> The argumentation reverses if the unemployment rate is used as dependent variable.

<sup>48</sup> In main text the lack of significance is explained by structural differences between the implied-contract exception and the other two wrongful-dismissal laws.



**Table 6** Public policy exception

Marginal effect at $\bar{U}_i$ plus								
Dep. variable	Variable	Coefficient	− 4	− 2	0	2	4	Region
log( <i>employment</i> − <i>to</i> − <i>population</i> )	$post_{i,t}$	− 0.039 (0.586)	2.371** (1.114)	1.166* (0.644)	− 0.039 (0.586)	− 1.243 (1.015)	− 2.448 (1.573)	Yes
	$post_{i,t} * \bar{U}_i$	− 0.602** (0.308)						
log( <i>employment</i> − <i>to</i> − <i>population</i> )	$post_{i,t}$	− 0.160 (0.770)	3.172** (1.396)	1.506* (0.788)	− 0.160 (0.770)	− 1.825 (1.365)	− 3.491* (2.106)	No
	$post_{i,t} * \bar{U}_i$	− 0.833** (0.403)						
log( <i>unemploymentrate</i> )	$post_{i,t}$	1.770 (4.795)	− 17.587* (10.087)	− 7.909 (5.680)	1.770 (4.795)	11.448 (8.598)	21.127 (13.604)	Yes
	$post_{i,t} * \bar{U}_i$	4.839* (2.743)						
log( <i>unemploymentrate</i> )	$post_{i,t}$	2.878 (6.705)	− 25.289** (12.158)	− 11.205* (6.670)	2.878 (6.705)	16.961 (12.215)	31.045* (18.901)	No
	$post_{i,t} * \bar{U}_i$	7.042* (3.602)						

Models are weighted by state's share of national population aged 16-64 in each month using CPS sampling weights. Standard errors in parentheses are computed using Huber-White standard errors, which allow for unrestricted error correlation within states

\*\*\*, \*\*, \* indicate statistical significance at the 1%, 5% and 10% confidence level.  $\bar{U}_i$  equals state  $i$ 's average unemployment rate in the 24 month before the introduction of the public policy exception

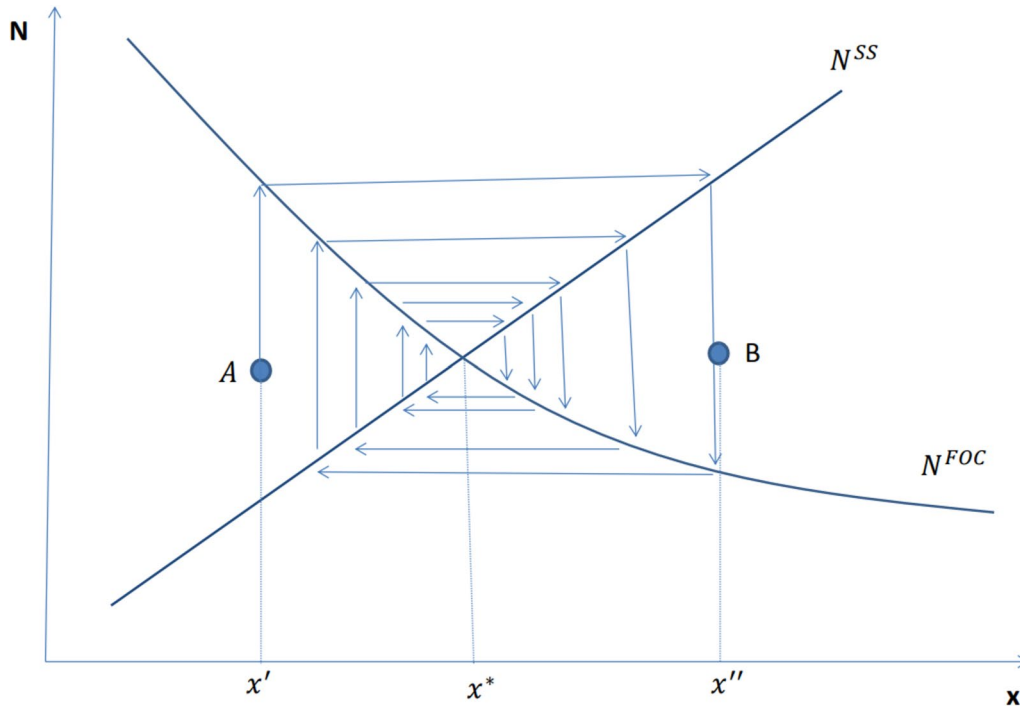
**Table 7** Good-faith-exception

Marginal effect at $\bar{U}_i$ plus								
Dep. variable	Variable	Coefficient	− 4	− 2	0	2	4	Region
log( <i>employment</i> − <i>to</i> − <i>population</i> )	$post_{i,t}$	− 0.949 (0.893)	8.108*** (2.693)	3.579*** (3.579)	− 0.949 (0.893)	− 5.478*** (2.065)	− 10.007*** (3.492)	Yes
	$post_{i,t} * \bar{U}_i$	− 2.264*** (0.747)						
log( <i>employment</i> − <i>to</i> − <i>population</i> )	$post_{i,t}$	− 0.551 (0.629)	7.554** (3.106)	3.501** (1.553)	− 0.551 (0.629)	− 4.603** (1.898)	− 8.656** (3.468)	No
	$post_{i,t} * \bar{U}_i$	− 2.026** (0.808)						
log( <i>unemploymentrate</i> )	$post_{i,t}$	7.961 (7.291)	− 67.193*** (19.213)	− 29.615*** (9.153)	7.961 (0.274)	45.538*** (0.006)	83.116*** (0.002)	Yes
	$post_{i,t} * \bar{U}_i$	18.789*** (5.642)						
log( <i>unemploymentrate</i> )	$post_{i,t}$	4.196 (6.291)	− 84.772*** (28.054)	− 40.288*** (13.566)	4.196 (6.291)	48.680*** (18.807)	93.164*** (33.562)	No
	$post_{i,t} * \bar{U}_i$	22.242*** (7.571)						

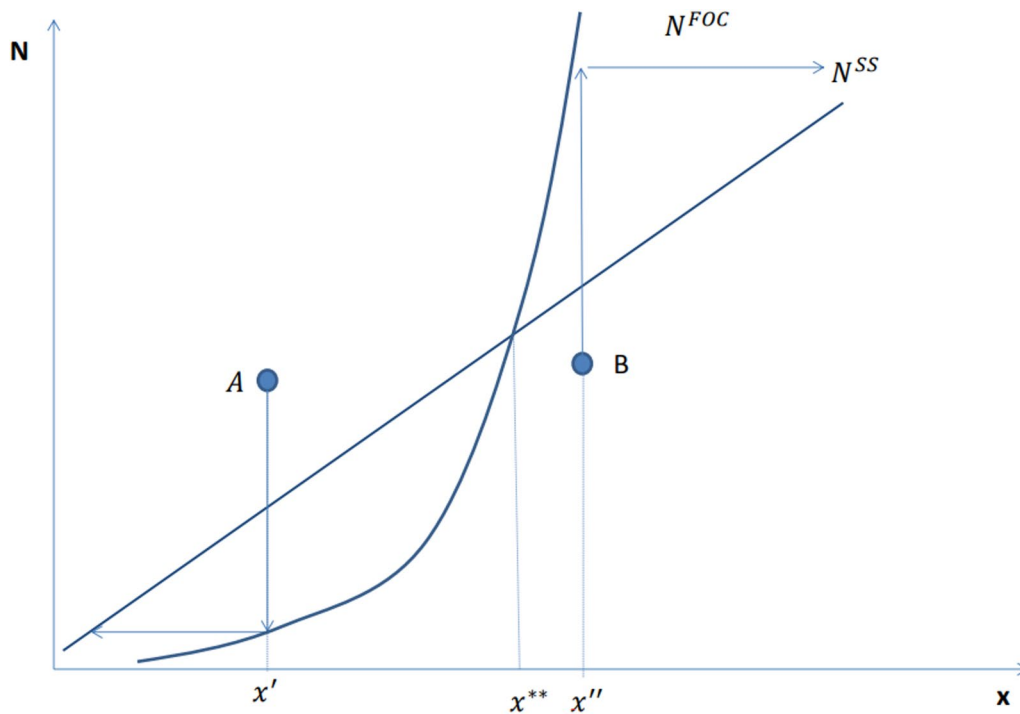
Models are weighted by state's share of national population aged 16-64 in each month using CPS sampling weights. Standard errors in parentheses are computed using Huber-White standard errors, which allow for unrestricted error correlation within states

\*\*\*, \*\*, \* indicate statistical significance at the 1%, 5% and 10% confidence level.  $\bar{U}_i$  equals state  $i$ 's average unemployment rate in the 24 month before the introduction of the good-faith exception

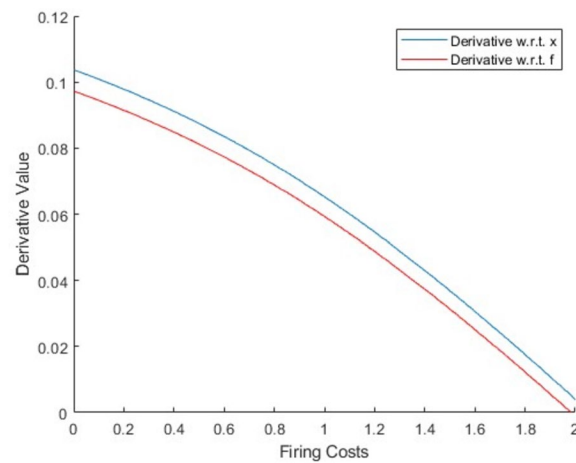
See Figures 4, 5, 6, 7, 8, 9



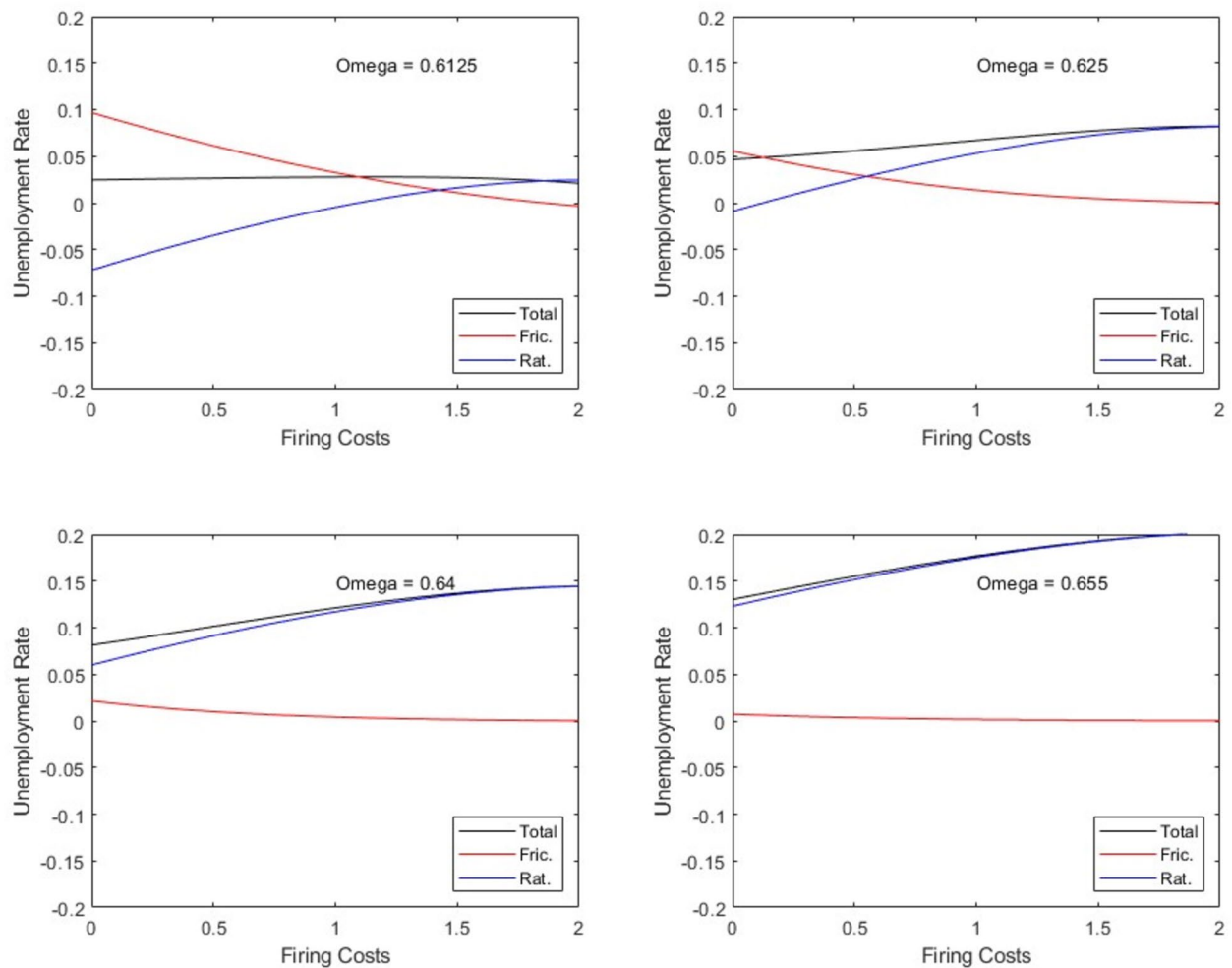
**Fig. 4** The figure shows the adjustment process resulting from a small deviation from the *low* market tightness equilibrium. Source: Own Simulations



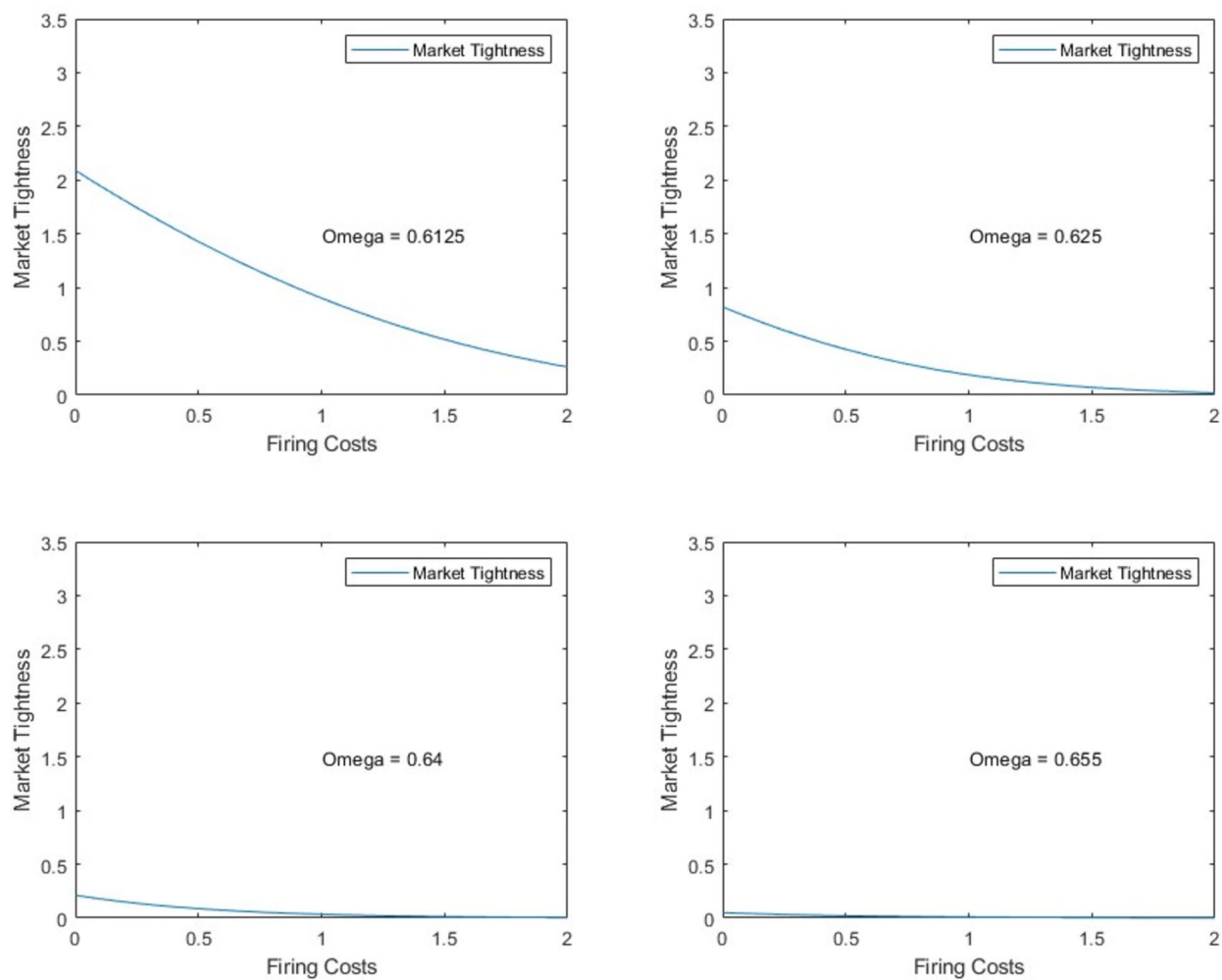
**Fig. 5** The figure shows the adjustment process resulting from a small deviation from the *high* market tightness equilibrium. Source: Own Simulations



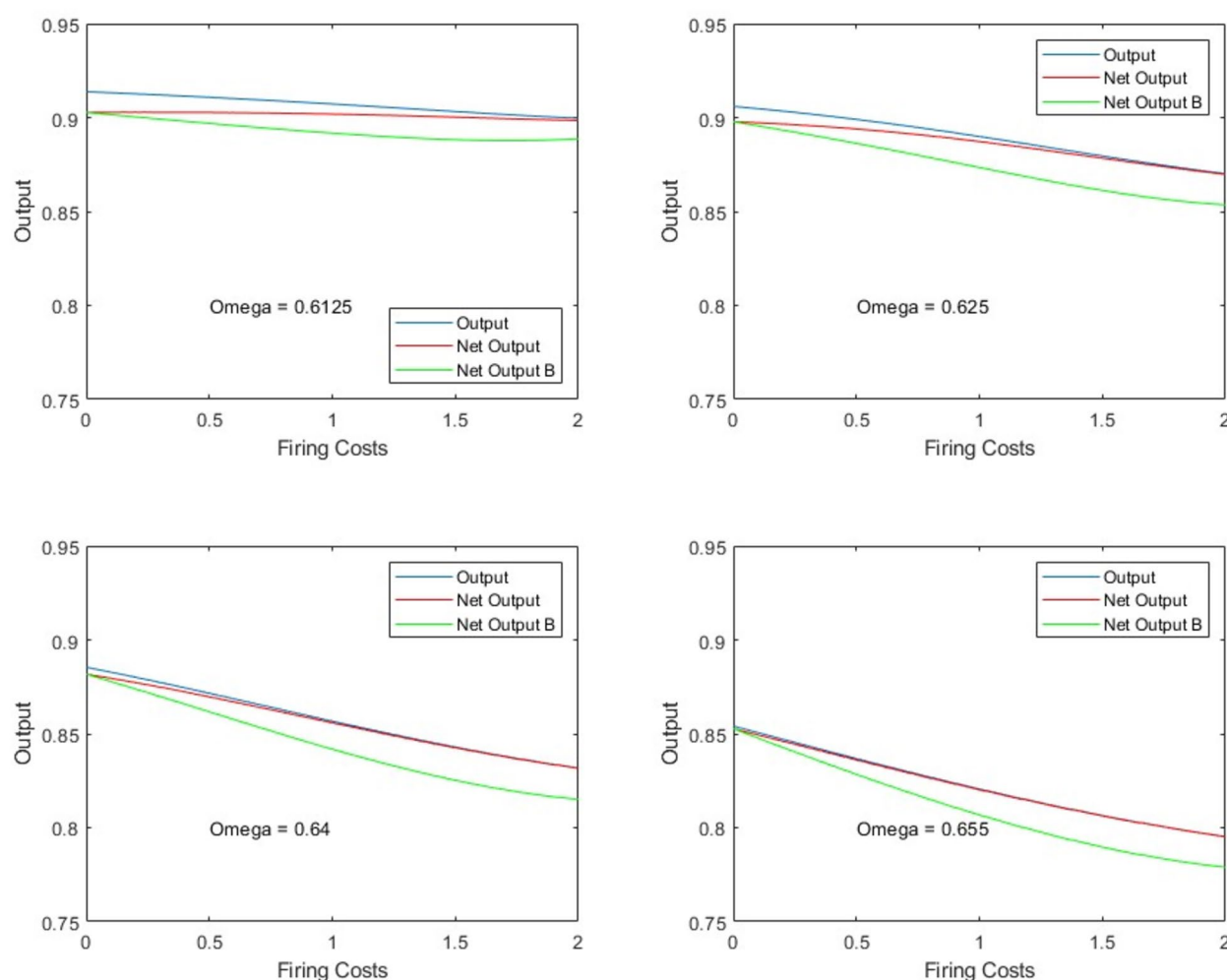
**Fig. 6** The figure shows the value of  $\frac{\partial N^{FOC}}{\partial x}$  (blue line) and  $\frac{\partial N^{FOC}}{\partial f}$  (red line) as functions of firing costs  $f$ . Source: Own Simulations



**Fig. 7** The figure shows total, frictional and rationing unemployment as a function of firing costs. Each graph results from a simulation using the exact same set of parameter values except of the wage parameter. Source: Own simulations



**Fig. 8** The figure shows equilibrium market tightness as a function of firing costs. Each graph results from a simulation using the exact same set of parameter values except of the wage parameter. Source: Own simulations



**Fig. 9** The figure shows total output and two definitions of net output as a function of firing costs. Net Output is calculated as total output net of recruiting expenditures, while Net Output B is calculated as Net Output minus total firing costs. Each graph results from simulation using the exact same set of parameter values except of the wage parameter. Source: Own simulations

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#### Availability of data and materials

The dataset used by Autor et al. (2006) is available on David Autor's webpage: <https://economics.mit.edu/people/faculty/david-h-autor/data-archive>. State level unemployment data is taken from the Current Population Survey. The resulting dataset analyzed in this paper is available on request.

#### Declarations

##### Consent for publication

Not applicable.

##### Competing interests

There are no competing interests regarding the present paper.

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#### References

- Acharya, V.V., Baghal, R.P., Subramanian, K.V.: Wrongful discharge laws and innovation. *Rev. Financ. Stud.* **27**(1), 301–346 (2014)
- Akerlof, G.: *An economic theorist's book of tales*. Cambridge University Press, Cambridge (1984)
- Addison, J.T., Teixeira, P.: The economics of employment protection. *J. Lab. Res.* **24**(1), 85–128 (2003)



- Allard, G., Lindert, P.: Euro-productivity and euro-jobs since the 1960s: which institutions really mattered? In: The new comparative economic history: essays in honor of Jeffrey G. Williamson. The MIT Press, Cambridge (2007)
- Autor, D., Donohue, J., Schwab, S.: The costs of wrongful-dismissal-laws. *Rev. Econ. Stat.* **88**(2), 211–231 (2006)
- Autor, D., Kerr, W., Kugler, A.: Does employment protection reduce productivity? Evidence from U.S. States. *Econ. J.* **117**(521), 189–217 (2007)
- Barro, R., Grossman, H.I.: A general disequilibrium of income and employment. *Am. Econ. Rev.* **61**(1), 82–93 (1971)
- Bartelsmann, E., Gautier, P., De Wind, J.: Employment protection, technology choice and worker allocation. *Int. Econ. Rev.* **57**(3), 787–826 (2016)
- Bastgen, A., Holzner, C.: Employment protection and the market for innovation. *Labour Econ.* **46**, 77–93 (2017)
- Belot, M., Boone, J., Ours, J.V.: Welfare-improving employment protection. *Economica* **74**(295), 381–396 (2007)
- Bertola, G., Blau, F.D., Kahn, L.M.: Labor market institutions and demographic patterns. *J. Popul. Econ.* **20**(4), 833–867 (2007)
- Blanchard, O., Gali, J.: Labor markets and monetary policy: a new Keynesian model with unemployment. *Am. Econ. J. Macroecon.* **2**(2), 1–30 (2010)
- Boeri, T., Garibaldi, P.: Two tier reforms of employment protection: a honeymoon effect? *Econ. J.* **117**(521), 357–385 (2007)
- Botero, J., et al.: The regulation of labor. *Q. Econ.* **119**(4), 1339–1382 (2004)
- Breen, R.: Explaining cross-national variation in youth unemployment: market and institutional factors. *Eur. Sociol. Rev.* **21**(2), 125–134 (2005)
- Bun, M., Harrison, T.: OLS and IV estimation of regression models including endogenous interaction terms. *Economet. Rev.* **38**(7), 814–827 (2019)
- Cahuc, P., Carcillo, S., Zylberberg, A.: Labor economics, 2nd edn. The MIT Press, Cambridge (2014)
- Cahuc, P., Carcillo, S., Patault, B., Moreau, F.: Judge bias in labor courts and firm performance. *J. Eur. Econ. Assoc.* **22**(3), 1319–1366 (2023)
- Clark, A.: What makes a good job? Evidence from OECD countries. In: Job quality and employer behaviour, pp. 11–30. Palgrave Macmillan, London (2005)
- D'Arcy, P., Gustafsson, L., Lewis, C., Wiltshire, T.: Labour market turnover and mobility. *Reserve Bank Aust. Bull.* (2012) pp. 1–12
- Edelman, L., Abraham, S., Erlanger, H.: Professional construction of law: the inflated threat of wrongful discharge. *Law Soc. Rev.* **26**(1), 47–84 (1992)
- Esping-Andersen, G.: Who is harmed by labour market regulations? Quantitative evidence. In: Why deregulate labour markets?, pp. 66–98. Oxford Academic, Oxford (2000)
- Hagedorn, M., Manovskii, I.: The cyclical behavior of equilibrium unemployment and vacancies revisited. *Am. Econ. Rev.* **98**(4), 1692–1706 (2008)
- Hall, R.E.: Employment fluctuations with equilibrium wage stickiness. *Am. Econ. Rev.* **95**(1), 50–65 (2005)
- Heckman, J., Pages-Serra, C.: The cost of job security regulation: evidence from Latin American Labor Markets. *Econ. J.* **110**(1), 109–154 (2000)
- Kahn, L.: The impact of employment protection mandates on demographic temporary employment patterns: international microeconomic evidence. *Econ. J.* **117**(521), 333–356 (2007)
- Lazear, E.: Job security provisions and employment. *Q. J. Econ.* **105**(3), 699–726 (1990)
- Macleod, W.B., Nakavachara, V.: Can wrongful discharge law enhance employment. *Econ. J.* **117**(521), 218–278 (2007)
- Michaillat, P.: Do matching frictions explain unemployment? Not in bad times. *Am. Econ. Rev.* **102**(4), 1721–1750 (2012)
- Mortensen, D., Pissarides, C.: Job creation and job destruction in the theory of unemployment. *Rev. Econ. Stud.* **61**(3), 397–415 (1994)
- Muhl, C.J.: The employment-at-will doctrine: three major exceptions. *Mon. Labor Rev.* **124**(1), 3–11 (2001)
- Noelke, C.: Employment protection legislation and the youth labour market. *Eur. Sociol. Rev.* **32**(4), 471–485 (2016)
- OECD: The OECD jobs study: facts, analysis, strategies. OECD, Paris (1994)
- Petrongolo, B., Pissarides, C.A.: Looking into the black box: a survey of the matching function. *J. Econ. Lit.* **39**(2), 390–431 (2001)
- Pierre, G., Scarpetta, S.: Do firms make greater use of training and temporary employment when labor adjustment costs are high? *IZA J. Labor Policy* **2**(15), 1–17 (2013)
- Pissarides, C.A.: Equilibrium unemployment theory, 2nd edn. The MIT Press, Cambridge (2000)
- Pissarides, C.: Employment protection. *Labour Econ.* **8**(2), 131–159 (2001)
- Pissarides, C.A., Petrongolo, B.: Looking into the black box: a survey of the matching function. *J. Econ. Lit.* **39**(2), 390–431 (2001)
- Schwab, S.J.: Life-circle justice: accommodating just cause and employment at will. *Mich. Law Rev.* **92**(1), 8–62 (1993)
- Shepotylo, O., Vakhitov, V.: Market power, productivity and distribution of wages: theory and evidence with micro data. *IOS Working Papers*. (387): 1–46. 2020.
- Shimer, R.: The cyclical behavior of equilibrium unemployment and vacancies. *Am. Econ. Rev.* **95**(1), 25–49 (2005)
- Soskice, D.: German technology policy, innovation and national institutional frameworks. *Ind. Innov.* **4**(1), 75–96 (1997)
- Stole, L., Zwiebel, J.: Intra-firm bargaining under non-binding contracts. *Rev. Econ. Stud.* **63**(3), 375–410 (1996)
- Sunde, U., Fahr, R.: Regional dependencies in job creation: an efficiency analysis for western Germany. *Appl. Econ.* **38**(10), 1193–1206 (2006)
- U.S. Bureau of Labor Statistics (2024) <https://fred.stlouisfed.org/series/LNU03000000>. Accessed 2 Feb 2024
- Wasmer, E.: Interpreting Europe and US labor markets differences: the specificity of human capital investments. *Am. Econ. Rev.* **96**(3), 811–831 (2006)
- Zoega, G., Booth, A.: On the welfare implications of hiring costs. *Eur. J. Polit. Econ.* **19**(4), 759–775 (2003)

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