Endogenous Wage Rigidity and Layoffs

Andrei Zaloilo*†

Toulouse School of Economics

November 28, 2025

Click here for the latest version

Abstract

Wage rigidity has long been considered an important source of employment fluctuations. I propose a theory in which rigid wages and layoffs arise endogenously and are correlated across workers and firms, yet rigid wages do not cause layoffs. I build an equilibrium search model where firms employ risk-averse workers of heterogeneous match quality on dynamic contracts. Asymmetric information about match quality generates privately inefficient layoffs. After negative productivity shocks, firms fire low-quality matches while smoothing survivors' wages. The model predicts heterogeneous composition of income risk: recently hired workers face higher layoff risk, whereas senior workers experience larger wage movements. I confirm this pattern using French matched employer–employee data. Moreover, *exogenous* wage rigidity, stemming from minimum wages, has limited effects on employment when rigid wages and layoffs have endogenous foundations. A calibration shows that a minimum wage hike has only muted effects on firing and hiring rates.

*Email: andrei.zaloilo@tse-fr.eu

†I am extremely grateful to Christian Hellwig, Eugenia Gonzalez-Aguado, Dirk Krueger, and Nicolas Werquin for their invaluable advice and continuous guidance. I also thank Charles Brendon, Fabrice Collard, Alessandro Dovis, Patrick Feve, Alexandre Gaillard, Patrick Kehoe, Gerard Maideu Morera, Iourii Manovskii, Pablo Mileni Munari, Guillermo Ordonez, Elena Pastorino, Edouard Schaal, Simon Scheidegger, Oscar Vilargunter, Philipp Wangner, Wenxuan Xu, Miguel Zerecero, and participants at various seminars for constructive comments and insightful discussions. All errors are mine.

1 Introduction

Wage rigidity has long been considered a key driver of employment fluctuations (Keynes 1936), operating along both hiring and layoff margins: when firms cannot adjust wages for exogenous reasons, they adjust employment instead. This paper provides a counterargument to this view on the layoff margin of adjustment.

I propose a theory in which rigid wages arise *endogenously* as a consequence, not a cause, of layoffs. The main intuition is that, following a negative productivity shock, firms use layoffs to shed the less productive workers. Wage rigidity then arises as an outcome of improved worker composition: the surviving workers are of higher average productivity, making wage cuts less desirable. My model predicts that this link between layoffs and rigid wages persists across firms and, surprisingly, across worker tenure: recently hired workers are subject to higher layoff risk, but lower wage pass-through than more senior workers. I test and confirm these predictions in the French administrative data.

Of course, even if wage rigidity is endogenous, exogenous institutional constraints such as the minimum wage clearly exist in some economies. These constraints may directly affect employment by limiting firms' ability to adjust wages. To assess their quantitative importance in amplifying employment fluctuations, I calibrate the model to France and study the effects of minimum wage. I find that a counterfactual minimum wage increase would have muted impact on firing and even hiring rates. This suggests that, in the presence of endogenous reasons for firms to smooth wages and fire workers, even exogenous wage rigidity has only a limited impact on overall employment fluctuations.

I begin my argument by describing the model. I build an equilibrium model of the labor market with search frictions and one-sided limited commitment on the worker side. Firms employ a continuum of workers, face firm-wide productivity shocks and decreasing returns to scale. Search is directed: firms post dynamic contracts to attract workers. Contracts specify future productivity-history-contingent wages, layoff risk, and severance pay conditional on layoffs. Workers are risk-averse and cannot commit to stay, whereas firms can credibly insure workers against future productivity shocks. Firms therefore face a trade-off between insuring workers against future losses and incentivizing workers to stay (leave) when they are most (least) productive.

Under symmetric information about match surplus, the Coase theorem applies to layoffs and matches would be destroyed if and only if surplus were negative. Layoffs would therefore be entirely disconnected from wages, inconsistent with previously documented cross-firm correlation between wage rigidity and layoffs (Dias, Marques, and Martins 2013; Ehrlich and Montes 2024). I depart from this benchmark by introducing asymmetric information:

upon hiring, each match draws a permanent quality component that is observed only by the firm. The firm may choose not to reveal this information in order to further insure its workers, and thus effectively refrains from wage-discriminating across workers on the same contract. This generates privately inefficient layoffs: after negative productivity shocks, firms fire low-quality matches. The connection between layoffs and rigid wages arises through the change in workforce composition: the surviving matches on the same contract are now of higher average quality. The firm wants to protect these workers from being poached and thus optimally keeps their wages relatively high (possibly even raising them) despite the negative shock. This mechanism is central to the paper's view of layoffs and pay cuts: wherever the firm chooses to fire workers, it has less desire to cut survivors' wages.

A novel prediction of my model is that the layoff–wage connection exists both between and *within* firms, across worker tenure. When choosing whom to lay off, it is optimal to eliminate the workers who would require the smallest compensation for the ex-ante layoff risk, the recent hires. The model thus generates relatively higher layoff rates among the most junior workers. Individual layoff risk depends on both absolute tenure and relative tenure within the firm: the most junior (and least costly) workers are cut first, consistent with last-in, first-out patterns documented by Buhai et al. (2014). After layoffs, the firm has less incentive to cut the wages of surviving juniors than of seniors, whose average quality has not improved. The model therefore predicts that junior workers face higher layoff risk but lower wage pass-through than more senior workers. I treat this as a testable implication to be validated in the data.

I use French matched employer–employee data merged with firm production data from 2009–2019 to test the model's predictions. First, I confirm the literature's finding (Ehrlich and Montes 2024) that firms that lay off the most exhibit the most rigid wages. I document both the layoff rate and the pass-through of firm-level productivity shocks to the wages of job stayers. Grouping firms by average layoff rates, I find that after a negative productivity shock normalized to 100%, wages in firms firing the least fall by 1.7%, whereas wages in firms firing the most in fact *rise* by 0.2%.

I then confirm the model's prediction that the connection between layoffs and wage rigidity holds not only across firms but also within firms, across tenure. Workers with tenure below two years face layoff rates of 5–11%, compared with 2% for workers with four to five years of tenure. By contrast, wages of workers with less than one year of tenure *rise* by 0.8% in response to negative productivity shocks, whereas more senior workers' wages fall by 2.4%. Lastly, I examine wage response to layoffs. I find that, on average, wages *rise* in response to layoffs in the firm, and that the effect comes primarily from layoffs in the worker's cohort, consistent with the model's workforce composition channel of wage rigidity.

Moreover, whenever firms lay off workers, a wage gap between senior and junior workers widens.

I then use the model to quantify how firms choose between wage changes and layoffs in response to productivity shocks. I calibrate the model using simulated method of moments with moments on labor market flows, firm productivity shocks, and firm size estimated from my matched employer–employee data. The model accounts well for the differential response of wages and layoffs to firm-level productivity shocks across cohorts, which are not targeted in the quantification. Impulse response analysis shows that, following negative productivity shocks, junior workers experience significantly larger spikes in layoff risk but almost no wage cuts.

France is a particularly suitable setting for this study because of its strong labor policies, which I leverage to compare the mechanism of my model with alternative explanations for rigid wages, layoffs, and their heterogeneity. The model incorporates the main labor market policies in place in France, including the minimum wage and severance pay, both of which are substantial relative to the OECD average.

I first consider the impact of severance pay. In France, although legal severance pay is not high and does not rise much with tenure, in practice firms often reach generous agreements with workers or their representatives (Kramarz and Michaud 2010). This may pose a challenge for my mechanism, as both legal and de facto severance pay scale with tenure, providing an alternative explanation for my empirical findings. To address this concern, I introduce firm-chosen, contract-specific severance pay into the model. I find that it is optimal for firms to offer substantial severance pay. The optimal severance is increasing in tenure and exceeds the legal lower bound, consistent with the situation in France. Intuitively, firms use severance pay to smooth workers' utility, effectively making it *cheaper* to fire workers than to overcompensate them ex ante for layoff risk.

Second, I consider the impact of a prevalent source of exogenous wage rigidity in France: the minimum wage. I first consider removing the minimum wage to evaluate its role in generating heterogeneity across worker tenure. I find that the impact of removing the minimum wage on layoffs and wage pass-through across worker tenure is small. I then consider the impact of minimum wage on employment fluctuations. Standard theories would predict that a minimum wage increase would result in notably more rigid wages, higher layoff rates, and a lower job-finding rate. In contrast, I find that its impact on both layoffs and the job-finding rate is muted. More precisely, a 20% minimum wage increase raises annual layoff rate by 0.2 percentage points and cuts the hiring rate by 1 percentage point. The intuition is that, unlike in models of exogenously rigid wages, layoffs have value for firms even when wage cuts are available. Moreover, because firms intentionally choose to smooth workers' wages, the minimum wage bound, even when reached, is not as strongly binding for firms. Lastly, for hiring, firms work with dynamic wage contracts that exhibit endogenous wage growth. Therefore, binding minimum wage only serves to rearrange the optimal wage profile to more frontloaded wages rather than force firms to pay higher wages perpetually. Overall, this finding suggests that, in presence of endogenous reasons for firms to fire workers and smooth wages, even exogenous sources of wage rigidity have a limited impact on employment fluctuations.

The assumption that firms do not wage-discriminate within a contract is central to this paper. In principle, even under asymmetric information, firms could reveal information through wages to influence workers' search decisions. I offer three justifications.

First, the model's intuition aligns with recent survey evidence on firms' trade-off between wage cuts and layoffs (Bertheau et al. 2025). When asked why they prefer layoffs to wage cuts, firms most commonly answer that "layoffs give better control over who leaves the firm." Formalizing this logic requires layoffs to be a more precise instrument than wages for controlling match destruction. More broadly, recent evidence (Jäger, Schoefer, and Zweimüller 2022; Bertheau et al. 2025; Davis and Krolikowski 2025) points to inefficient layoffs and multilateral—rather than bilateral—wage agreements, both of which imply some degree of wage pooling. A key contribution of this paper is to show that even with fairly fine wage pooling, the model can generate substantial layoffs that are not highly sensitive to more aggregate sources of wage rigidity. Furthermore, the documented heterogeneity across tenure points in the direction of granularity of wage pooling consistent with my model.

Second, nondiscrimination law may limit selective wage changes: if firms cannot justify differential treatment across otherwise similar workers, they may be constrained from adjusting wages selectively. This does not restrict contracts from conditioning on observable quality. It is enough that firms have worker-level preferences that are unobserved by workers.

Third, I provide a microfoundation. In a simplified version of the model, firms choose whether to wage-discriminate, generating a signalling game in which discrimination can convey match quality. Under mild conditions, a pooling equilibrium exists. The no–wage-discrimination assumption in the main model can therefore be interpreted as the firm playing the pooling equilibrium of this larger signalling game.

Because firms face decreasing returns to scale, they manage contracts jointly across employees. In principle, this renders the model intractable: in a recursive formulation, the firm would need to track contracts for a continuum of workers, resulting in an infinite-dimensional state space. Fortunately, with directed search, a firm hires all workers on the same contract within a given period. It is therefore sufficient to track contracts by cohort. This discretizes the state space and makes it finite for firms of finite age: a firm of age ten employs at most ten cohorts. Moreover, up to an approximation, the state space can be bounded: I show theoretically and empirically that cohort wages tend to converge. I use this observation to justify pooling workers beyond a tenure threshold onto the same contract. Thus, instead of optimizing over a continuum of contracts, it suffices to work with a finite set of tenure-specific contracts.

Related Literature This paper contributes to the literature on the roots of wage rigidity. Broadly, two views exist. One treats rigid wages as the endogenous outcome of bilaterally efficient bargaining (Barro 1977; Thomas and Worrall 1988; Balke and Lamadon 2022; Elsby et al. 2024). The other models rigid wages as the result of exogenously imposed frictions (Christiano, Eichenbaum, and Evans 2005; Nekarda and Ramey 2020; Blanco et al. 2025). Only the latter can directly connect wage rigidity to layoffs: if firms are restricted from cutting wages, they resort to layoffs. This paper connects wage rigidity and layoffs while taking inspiration from the bilaterally efficient view: firms optimally choose both to fire some workers and to refrain from cutting survivors' wages.

The model sits at the intersection of dynamic contracts, firm dynamics, and match heterogeneity.

First, it relates to optimal wage contracts in long-term employment. Building on Thomas and Worrall (1988) and Harris and Holmstrom (1982), optimal contracts have been studied in rich search environments by Burdett and Coles (2003), Menzio and Shi (2011), Fukui (2020), Balke and Lamadon (2022), Souchier (2022), Malgieri and Citino (2024), and Elsby et al. (2024), with emphasis on on-the-job search. Closest are Balke and Lamadon (2022), Souchier (2022), and Malgieri and Citino (2024), who study the insurance–incentives trade-off between risk-averse workers and risk-neutral firms. My contribution is to incorporate layoffs into the insurance contract: firms can pass through negative shocks by either cutting wages or firing workers. Within dynamic insurance contracts, this is also the first paper to allow decreasing returns to scale, so firms jointly manage insurance across their workforce. The closest counterpart is Schaal (2017), where firms with decreasing returns to scale offer dynamic contracts to risk-neutral workers.

Second, it connects to search-and-matching models with firm dynamics, including Acemoglu and Hawkins (2014), Elsby and Michaels (2013), Kaas and Kircher (2015), Schaal (2017), and more recently Gulyas (2020), Bilal et al. (2022), Elsby and Gottfries (2021), McCrary (2022), Rudanko (2023). Relative to Schaal (2017), this paper introduces dynamic contracts with worker–firm risk insurance into this setting. Dynamic contracts are crucial to reconciling within-firm heterogeneity in layoffs and wage pass-through: unlike models with Nash bargaining (McCrary 2022) or sequential bargaining (Bilal et al. 2022), workers in the same firm may optimally face different wage paths, layoff risks, and responses to productivity shocks.

Lastly, it relates to models that use match heterogeneity to generate layoffs, such as Berger (2011), Menzio and Shi (2011), and Gregory, Menzio, and Wiczer (2021). In Menzio and Shi (2011) and Gregory, Menzio, and Wiczer (2021), matches dissolve when they become sufficiently unproductive. Berger (2011) use match heterogeneity to explain countercyclical labor productivity and jobless recoveries. The cycle is similar here: firms grow "fat" in high-productivity states and cleanse their workforce when negative shocks arrive. My contribution adapts this mechanism to the wage–firing trade-off: unlike Berger (2011), firms are free to change workers' wages but choose not to because, after layoffs, their remaining workers are sufficiently valuable to retain.

On the empirical side, this paper draws on the evidence from Bewley (1999). Bertheau et al. (2025) and Davis and Krolikowski (2025), both studying the wage-cut–layoff trade-off. Davis and Krolikowski (2025) survey unemployed workers and find that, while many were open to substantial pay cuts, firms rarely initiated such discussions before resorting to layoffs. Some respondents also conjecture that wage cuts could induce the best workers to leave, suggesting firms do not have complete control over individual wages. On the firm side, Bertheau et al. (2025) merge a large-scale firm survey with administrative data to study incentives to cut wages versus fire workers. They find that wage cuts are often a poor substitute for layoffs because firms want to get rid of particular workers. This paper provides a theoretical foundation for these empirical results.

Lastly, this paper relates to a broad set of studies measuring wage pass-through and, separately, layoffs. My average pass-through estimates align with Souchier (2022) and with estimates from other countries (Guvenen et al. 2017; Guiso and Pistaferri 2020). I document novel differences in wage pass-through by worker tenure: junior workers are subject to negative pass-through, while more senior workers at the firm are subject to a positive and increasing pass-through of productivity shocks on to wages. On layoffs, Buhai et al. (2014) shows that last-in workers are typically the first to leave the firm; both my empirical results and my model are consistent with this pattern. The cross-firm link between layoffs and pass-through is consistent with empirical work by Dias, Marques, and Martins (2013) and Ehrlich and Montes (2024).

The remainder of the paper proceeds as follows. Section 2 presents the model. Section 3 provides empirical validation to the model's predictions. Section 4 details the calibration and the quantitative results.

2 Model

I present a model of a frictional labor market in which firms sign workers of heterogeneous match quality to dynamic contracts. Layoffs help firms improve workforce composition, making wage cuts less desirable.

2.1 Environment

Time is discrete and indexed by t. The economy is populated by a continuum of firms of measure 1, indexed by $f \in [0,1]$, and a continuum of workers of measure I, indexed by $i \in [0,I]$. Both types of agents are ex ante homogeneous and infinitely lived, with time-separable preferences and discount factor β. Firms are owned by outside investors who diversify firm-specific productivity risk. Thus firms maximize

$$E_0 \sum_{t=0}^{\infty} \beta^t \pi_{ft}.$$

Workers are risk-averse and have no access to financial markets. They consume home production b when unemployed and wage w when employed. Their utility is

$$E_0 \sum_{t=0}^{\infty} \beta^t u(c_{it}), \qquad u(c) = \frac{c^{1-\sigma}}{1-\sigma}.$$

Production

Firms may pay κ_e to start producing and must pay κ_f, representing capital costs of production, each period to remain open. Active firms employ a measure[1] n of workers. Each worker–firm match is either high or low productivity, and its type is fixed for the duration of the match. Match quality is privately observed by the firm, while the share of high-quality matches within the firm, z, is common knowledge. Production is subject to firm-level shocks $y \in \mathcal{Y}$ and exhibits decreasing returns to scale in numbers of high- and low-productivity matches, n_H and n_L:

$$Y(y,n,z) = yF(n_H,n_L), \qquad n = n_H + n_L, \quad z = \frac{n_H}{n_H + n_L},$$

where $F(n_H,n_L)$ is a strictly increasing, concave production function with $F(0,0)=0$ and $F'_{n_H} > F'_{n_L}$. For notational convenience, I henceforth work with (n,z) and write $F(n,z)$ for the implied mapping from (n,z) to (n_H,n_L).

[1] The law of large numbers applies and is used throughout (Sun and Zhang 2009).

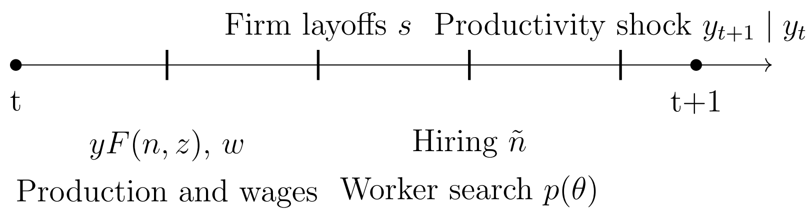


Figure 1: Within-period timeline

Labor market

Each period, entering firms begin with measure 1 of workers, corresponding to the entrepreneur/owner of the firm; incumbent firms choose to hire $\tilde{n} \geq 0$ workers. Workers—both employed and unemployed—search for jobs. Matching occurs in a frictional labor market with directed search, as in Moen (1997). There is a continuum of submarkets indexed by the promised value v to the worker. Firms choose in which submarket to post vacancies at cost c, and workers choose where to search. Within each submarket, matches are formed according to a constant-returns-to-scale matching function; market tightness θ_v, representing the vacancy-workers ratio in a submarket, suffices to determine matching probabilities. Let $p(\theta_v)$ and $q(\theta_v) \leq 1$ denote the job-finding and vacancy-filling probabilities.

Firms are not restricted to a discrete number of vacancies and can deterministically hire $\tilde{n}$ workers from submarket v at cost $\tilde{n}\, c/q(\theta_v)$. The probability of a newly hired match having high productivity is $z_0 \in [0, 1]$, constant across agents and time. Upon hiring, the firm commits to deliver expected discounted utility v. The hiring trade-off is between the cost of hiring, $c/q(\theta_v)$, and the (higher) cost of employing a worker as v rises. Firms can downsize by laying off a fraction $s \in [0, 1]$ of their workforce and by incentivizing incumbents to find jobs elsewhere. Lastly, firms can choose to compensate laid off workers by offering perpetual severance pay sev until they find a new job[2].

Timing

Each period has four stages (Figure 1). First, production occurs: the firm collects output and pays wage w to each worker. Next, the firm lays off a fraction $s \geq 0$ of its workforce. Fired workers become unemployed and cannot search until next period. Then all workers—employed and unemployed—search, and all firms (entrants and incumbents) hire

[2] In practice, firms offer lump-sum severance pay rather than a perpetual sum. However, without worker's ability to save and consume this sum over multiple periods, the lump-sum pay is not impactful on worker's expected utility. I use perpetual severance as a proxy for the unemployed workers' ability to smooth their consumption

$\tilde{n}$. Hiring and search choices occur before next-period productivity y_{t+1} is realized, so agents take expectations $E_{y_{t+1}|y_t}$.

Uncertainty

With hiring being deterministic, there are two sources of uncertainty in the model: firm-level productivity, varying over time, and match quality, constant upon the match forming. Workers are atomistic, making the firm-level shocks the only source of uncertainty at the firm level. Because firms hire a continuum of workers, a fixed measure of new highly hired workers, z_0, exhibits high quality. Firms then need not concern themselves with the outcome of the quality draw of any particular match. On the workers' side, although they are ex-post concerned with their own match quality, ex-ante they are not aware of their draw. Therefore, just like the firm, workers make their decisions keeping in mind only the measure of the high qual matches.

In the aggregate, the model is deterministic because firms themselves are also atomistic. Each firm-level productivity path is reached by a measure of firms corresponding to the ex-ante probability of reaching said path. Therefore, there is no aggregate uncertainty in the model.

However, during a transition path into the steady-state firms may still need to track the aggregate cross-sectional distribution. To alleviate this, I restrict attention to two versions of the economy: a steady state and, under an additional assumption (Appendix A.5), a block-recursive equilibrium following Menzio and Shi (2011) and Schaal (2017). In either case, firms no longer need to track the aggregate cross-sectional distribution.

Information structure and contracts

Upon hiring, the firm commits to deliver expected utility v via a contract. A contract specifies wages and actions for the matched pair for all future firm-productivity histories $y^\tau \equiv (y_1, \ldots, y_\tau) \in \mathcal{Y}^\tau$. Firm productivity histories are common knowledge and therefore fully contractible. By contrast, match-specific productivity z_{if} is private to the firm, and the worker's search decision $\hat{v}$ is private to the worker. The contract is

$$\mathcal{C} = \{w_\tau,\, s_\tau,\, sev_\tau,\, \hat{v}_\tau\}_{\tau=t}^{\infty}. \tag{1}$$

Here w is the wage policy for each future productivity history. The second component, s, is the *expected* layoff probability from the worker's perspective (who does not observe their match quality). These probabilities are history-dependent: in histories where information about match quality is updated, future layoff probabilities reflect the worker's Bayesian update. For example, after multiple negative shocks that force large layoffs, remaining workers rationally assign higher probability to being high productivity, and subsequent layoff probabilities adjust accordingly[3]. The third component is severance pay. Firm can commit to perpetually pay severance *sev* to laid off workers until they find a new job. The last component is the worker's (unobserved) search decision. I focus on contracts in which recommended search is incentive compatible, i.e., the contract specifies workers' search choices subject to the constraint that those choices are optimal for workers.

The contract space allows fully flexible wage and layoff responses to productivity histories. With a continuum of concurrent contracts, the firm can choose how to treat a heterogeneous workforce (by productivity and contract): when a negative shock hits, whom to fire and whose wages to cut. This feature is central and specific to the setting: unlike models with CRS production, these decisions depend on the entire distribution of contracts of match productivities, as well as firm size; unlike dynamic models with Nash bargaining (McCrary 2022) or sequential bargaining (Bilal et al. 2022), workers within the same firm may optimally face different wages, layoff risks, and responses to shocks.

Asymmetric information and no wage discrimination

Firms have private information about each match's quality. In principle, they can choose to disclose this information in order to more effectively wage discriminate or withhold it in order to further insure the workers. This is essentially a signalling game that firms and their workers play.

In Appendix A.3 I consider a simplified version of such a game in order to assess the firm's trade-offs between the two options. I show that, under a sufficiently inelastic probability of retaining a worker, a pooling equilibrium exists and is robust to the Intuitive Criterion (Cho and Kreps 1987). I use this result as suggestive that the pooling equilibrium of the larger game also exists and focus on its implications.

Practically, I thus assume that firms do not reveal any information to individual workers about their match quality except for via layoffs. They do not offer quality-specific wages, severance, or future value, and only reveal the information upon layoffs. An immediate implication is that workers on the same contract and with the same prior about their match

[3]This statement implicitly assumes that workers believe that the firm fires bad matches first. The firm has no reason to deviate from this no matter the workers' beliefs whom firm fired (and thus their own type). Firing less productive workers first is therefore a dominant strategy, and in the equilibrium workers internalize that. I henceforth work with the state-space where workers' beliefs about the quality distribution are the same as the actual distribution.

quality (for example, workers hired at the same period, as I show later) will also have the same posterior about their individual quality, as long as they stay employed. I discuss the importance and realism of this assumption in Section 2.6.

Labor Market Policies

I introduce two key labor market policies, prevalent in France: minimum wage and statutory severance pay. Both policies act as lower bounds on the choice variables of the firm: minimum wage restricts the wage that the firms may pay to any worker at any point in time, and severance pay, scaling with tenure [4], similarly restricts the minimum severance that the firm should offer upon layoffs.

Minimum wage is the key source of exogenous wage rigidity, particularly at the bottom of the wage distribution. The key intent of introducing minimum wage is to control for it as it may provide the alternative explanation for both rigid wages and layoffs.

Severance pay is introduced for similar reasons: it is an institutional feature that may offer an alternative explanation for the prediction of my model that junior workers suffer higher layoffs but lower wage pass-through than more senior workers.

2.2 Value functions

The contract and all agents' problems admit a recursive formulation. I begin with workers' problems and then turn to firms managing a continuum of contracts. I show that the firm's problem can be reformulated with a discrete state space.

Worker's problem

Unemployed workers consume home production b as well as any severance they are offered. Each period they choose the submarket that offers the best trade-off between promised future utility and job-finding probability. In a stationary equilibrium (suppressing time subscripts), the value of unemployment U is

$$U(sev) = \ u(b + sev) + \beta \max_{v} \left[(1 - p(\theta_v))U(sev) + p(\theta_v)v\right]. \tag{2}$$

Consider an employed worker owed value v. Suppose the firm pays wage w this period, lays off with probability s, offers severance sev, and promises future value v' from next period onward. The worker's search problem is

$$v = \ u(w) + \beta\Big[sU(sev) + (1 - s) \max_{\hat{v}} \big((1 - p(\theta_{\hat{v}}))v' + p(\theta_{\hat{v}})\hat{v}\big)\Big]. \tag{3}$$

[4] This is the key component of severance pay in France. I provide more details in Section 3.1.

The optimal search target $\hat{v}$ depends only on the promised v'. By raising v', the firm induces search in higher-$\hat{v}$ submarkets, lowering the probability that the worker exits. Equivalently,

$$v = u(w) + \beta\big[sU(sev) + (1-s)R(v')\big],$$

where $R(v') \equiv \max_{\hat{v}} \big[(1-p(\theta_{\hat{v}}))v' + p(\theta_{\hat{v}})\hat{v}\big]$ is the worker's optimal continuation value given promise v' and no layoff.

Firm's problem

A firm employs a measure n of workers. Let $P(v,z)$ denote the joint distribution of promised values owed to incumbents and their productivity. For each v, the firm chooses the wage w_v, layoff rate s_v, and next period's productivity-history–contingent promised values $\{v'_{v,y'}\}$. The firm may also hire $\tilde{n}$ workers at value $\tilde{v}$. Each match can be high or low productivity. I rewrite the joint distribution $P(v,z)$ into two distributions: distribution of values $P(v)$ and the proportion of high-productivity matches for each value $z(v)$. The firm cannot set match productivity-contingent wages; it affects match productivity only through layoffs.Because of this, for each set of workers on some value v, firms also optimally fire the less productive matches first: the only difference between firing more or less productive matches is in the effect on actual production, in which case it is always better to fire poor matches.

Lemma 1. *The recursive problem can be expressed recursively as*

$$\begin{aligned}
J(y,n,P(v),z(v)) = &\max_{\tilde{n},\tilde{v},\{w_v,s_v,sev_v,v'_{v,y'}\}} yF\big(n,\int z(v)dP(v)\big) - n\int w_v\,dP(v) - \tilde{n}\frac{c}{q(\tilde{v})} - \kappa_f \\
&- \beta n\int s_v \frac{sev_v}{1-\beta\big(1-p(\hat{\theta}_{sev_v})\big)}dP(v) + \beta\,E_{y'|y}\,J\big(y',n',P'_{y'}(v),z'_{y'}(v)\big) \\
s.t.\quad & u(w_v) + \beta\big[s_vU(sev_v) + (1-s_v)R(v'_v)\big] = v \quad \forall v, \\
& v'_v = E_{y'|y}\,v'_{v,y'} \quad \forall v, \\
& n' = n\int(1-s_v)\big(1-p(v'_v)\big)\,dP_v(v) + \tilde{n}, \\
& n'P'_{y'}(v) = n\int \mathbb{1}\{v'_{v,y'} \le v\}(1-s_v)\big(1-p(v'_v)\big)\,dP(v) + \mathbb{1}\{\tilde{v}\le v\}\tilde{n} \quad \forall v, \\
& n'z'(v) = n\int \mathbb{1}\{v'_{v,y'} \le v\}\min\{\frac{z(v)}{1-s_v},1\}dP(v) + \mathbb{1}\{\tilde{v}\le v\}\tilde{n}z_0 \quad \forall v, \\
& w_v \ge \underline{w} \quad \forall v, \\
& sev_v \ge \underline{sev}_v \quad \forall v
\end{aligned}$$

The firm maximizes the present value of profits subject to honoring each worker's promised value. Because search occurs before the next productivity state is realized, workers care about the expected promised value v'_v rather than particular realizations $v'_{v,y'}$. The last two constraints describe the laws of motion for firm size and the distribution of promises.

Discretizing the problem As written, the state includes a probability distribution—an uncountably infinite-dimensional object. I show that the state space can be discretized, yielding a countably infinite state. First, under directed search, a firm posts in a single submarket and hires at a single value $\tilde{v}$.[5] Hence, all workers hired in the same period by the same firm are owed the same expected utility—both at hiring and, given no quality-contingent wages, thereafter. It is therefore equivalent to work with the CDF $P(v)$ or the PMF $\mathbb{P}(V=v)$, with $P(v)=\sum_{v'\leq v}\mathbb{P}(V=v')$. For a firm of age $K<\infty$, there are at most K distinct promised values with positive probability, corresponding to cohorts by tenure $k=t-t_{\text{hired}}\leq K$. The state can thus be recast by tenure:

Lemma 2. *For a firm of age K, the problem $J(y,n,P(v),z(v))$ is equivalent to*

$$
\begin{aligned}
J\big(y,\{n_k,v_k,z_k\}_{k\leq K}\big) = \max_{\tilde{n},\tilde{v},\{w_k,s_k,sev_k,v'_{y',k}\}_{k\leq K}} \; & yF\Big(\sum_k n_k,\ \frac{\sum_k n_k z_k}{\sum_k n_k}\Big) - \sum_k w_k n_k - \tilde{n}\frac{c}{q(\tilde{v})} - \kappa_f \\
& - \beta\sum_k n_k s_k \frac{sev_k}{1-\beta\big(1-p(\hat{\theta}_{sev_k})\big)} + \beta\, E_{y'|y}\, J\big(y',\{n'_k,v'_k,z'_k\}_{k\leq K+1}\big) \\
s.t. \qquad & u(w_k)+\beta\big[s_k U(sev_k)+(1-s_k)R(v'_{k+1})\big]=v_k \quad \forall k\leq K, \\
& v'_{k+1}=E_{y'|y}\, v'_{k+1,y'} \quad \forall k\leq K, \\
& n'_{k+1}=n_k(1-s_k)\big(1-p(v'_{k+1})\big)+\tilde{n} \quad \forall k\leq K, \\
& z'_{k+1}=\min\Big\{\frac{z_k}{1-s_k},\,1\Big\} \quad \forall k\leq K, \\
& n'_0=\tilde{n}, \quad v'_0=\tilde{v}, \quad z'_0=z_0 \\
& w_k\geq \underline{w} \quad \forall k\leq K, \\
& sev_k\geq \underline{sev}_k \quad \forall k\leq K
\end{aligned}
$$

This representation both discretizes the state space and clarifies how layoffs and wages interact within cohorts. Although workers do not know their own match quality, they know the cohort-level share of high-quality matches. New hires start with z_0, and while z_k may evolve, all workers of the same tenure k share the same probability $z_k\geq z_0$ of being high quality. This probability, common knowledge to the firm and workers, depends on layoffs in the cohort.

[5] I rule out behavioral strategies by an individual firm: if indifferent across submarkets, it posts in only one of them. This does not prevent the labor market from being cleared as the firms are atomistic: fixing a firm state, some measure of firms will deterministically post in one submarket, and another – in the other submarkets that require vacancies for clearing.

Free entry and exit

Firms enter by paying κ_e. Upon entry, a firm draws productivity and starts with a single worker. Free entry pins down expected profits at entry:

$$\kappa_e \geq \max_{v_0} \Big(-\frac{c}{q(\theta_{v_0})} + \beta\, E_y\, J\big(y, \{1, 0, \ldots\}, \{v_0, \ldots\}, \{z_0, \ldots\}\big)\Big). \tag{4}$$

Incumbents pay an operating cost κ_f each period to stay open. Although firms are committed to every contract with their workers while open, firms are free to exit the market completely. Firms stay open as long as:

$$J\big(y, \{n_k, v_k, z_k\}\big) \geq 0. \tag{5}$$

2.3 Equilibrium

An equilibrium is a sequence of worker policies $\hat{v}$, firm policies $\{w_k, s_k, sev_k, v'_{y'_k}\}_k, \tilde{v}, \tilde{n}$, matching rates, and distributions of workers and firms across submarkets v such that, each period:

- Firms solve the problem in Lemma 2.
- Workers solve (2) and (3).
- Free-entry and free-exit conditions (4)–(5) hold.
- Job-finding and vacancy-filling probabilities are consistent with the matching function.
- Tightness θ_v is consistent with firms' posting and workers' search strategies.
- The labor market clears.

Under the assumption in Appendix A.5, the equilibrium may be block recursive—independent of the aggregate distributions. I use that assumption in the quantitative analysis, but not in the theoretical discussion, where I focus on the steady state described above.

2.4 Mechanism

I show how the model generates rigid wages, layoffs, and the connection between the two across worker tenure.

Wage growth I first discuss how the firm chooses to adjust wages of its incumbent employees.

Proposition 1. *For any state* $(y, \{n_k, v_k, z_k\})$*, wages evolve according to*

$$\frac{1}{u'(w'_{k+1})} - \frac{1}{u'(w_k)} = \eta(v'_{k+1})\, E_{y'|y} \frac{\partial J\big(y', \{n'_k, v'_{y',k}, z'_k\}\big)}{\partial n'_{k+1}}, \tag{6}$$

where $\eta(v'_{k+1}) \equiv \frac{\partial \log(1-p(v'))}{\partial v'}\big|_{v'=v'_{k+1}}$ *is the semi-elasticity of the job-finding probability with respect to the promised value.*

Proof. See Appendix A.1. □

This relationship captures the insurance–incentives trade-off that the firm faces. When the marginal value of a worker, $E_{y'|y}\big[\partial J/\partial n'_{k+1}\big]$, is positive, the firm prefers to retain workers and backloads wages (setting $w'_{k+1} > w_k$). When the marginal value is negative, the firm lowers wages to encourage quits. The sign of the value of retention depends on current productivity via the expectation operator. Therefore, the wage growth depends on how productive the firm is at the moment.

The model exhibits three sources of endogenous wage rigidity. First, workers are risk-averse and thus, by insuring workers against income risk, firm can pay workers a lower average wage. This tension between providing workers insurance against productivity shocks and incentives via wage backloading is at the core of dynamic contracting models with on-the-job search.

Corollary 1. *For any state* $(y, \{n_k, v_k, z_k\})$*, future value of retaining cohort* k *depends on the marginal productivity and future wage of said cohort:*

$$E_{y'|y} \frac{\partial J\big(y', \{n'_k, v'_{y',k}, z'_k\}\big)}{\partial n'_{k+1}} = E_{y'|y}\Big[y'(\underbrace{F'_n}_{\textit{Size effect}} + \underbrace{F'_z \frac{\partial z'}{\partial n'_{k+1}}}_{\textit{Quality effect}}) - w'_{k+1} + \beta E_{y''|y} \frac{\partial J\big(y'', \{n''_k, v''_{y',k}, z''_k\}\big)}{\partial n''_{k+2}}\Big]$$

Proof. See Appendix A.1 □

The other two sources of wage rigidity are unique to my model and show up through the value of worker retention. First, there is an counter-acting impact on any retention incentives via firm *size*: if a firm loses some of its workers, via on-the-job search or layoffs, the firm size will fall, propping up the productivity of a marginal worker. This effect is present in response to both positive shocks, when firms grow in size, and negative shocks, when firms shrink. The size effect on marginal productivity is equal across cohorts as can be seen in Corollary 1.

The last source of endogenous wage rigidity concerns worker *selection* and is cohort-specific. When firm fires bad matches, the average quality in the surviving cohort rises, incentivizing the firm to protect the survivors from poaching. This is a case of heterogeneous downward wage rigidity: cohorts that suffer the most layoffs will also benefit the most from this channel.

Both the size and the selection channels revolve around worker retention incentives. To understand further the impact of the channels on wage growth, I first define a value at which the wage growth would be zero.

Definition 1 (Target promised value and target wage)**.** *Fix a firm state* $\Omega \equiv \big(y, \{n_j, v_j, z_j\}_{j\leq K}\big)$ *and a cohort* $k \leq K$*. Let* $\Omega' = \big(y', \{n'_j, v'_j, z'_j\}_{j\leq K+1}\big)$ *denote next period's state induced by the firm's optimal policy in Lemma 2. Define the cohort-*k *expected marginal retention value*

$$M_k(\Omega) \;\equiv\; \mathbb{E}_{y'|y}\left[\frac{\partial J(\Omega')}{\partial n'_{k+1}}\right].$$

The target promised value $v^*_k(\Omega_{-k})$ *is the value of* v_k *solving*

$$M_k\big(y, \{n_j\}, v_0, \ldots, v_k, \ldots, \{z_j\}\big) = 0,$$

holding fixed $\Omega_{-k} \equiv (y, \{n_j, v_j, z_j\}_{j\neq k})$*.*

The target wage $w^*_k(\Omega_{-k})$ *is the wage associated with* $v^*_k(\Omega_{-k})$*:*

$$w^*_k(\Omega_{-k}) = u'^{-1}\left(-\frac{n'_{k+1}}{\partial J(\Omega')/\partial v'_{y',k+1}}\right),$$

At the target wage, the cohort's marginal profit is zero, making the firm indifferent to poaching (while still preferring to shed low-quality matches within the cohort). The target wage governs within-firm wage movements.

Proposition 2. *For any state* $(y, \{n_k, v_k, z_k\})$ *and cohort* k *there exists a target wage* w^*_k *such that:*

1. *Wages move toward the target:*

$$w_k \leq w^*_k \;\Rightarrow\; w_k \leq w'_{k+1} \leq w^*_k, \qquad w_k \geq w^*_k \;\Rightarrow\; w^*_k \leq w'_{k+1} \leq w_k.$$

2. *The farther from target, the faster the adjustment. For any two cohorts* k, k'*:*

$$|w_k - w^*_k| \geq |w_{k'} - w^*_{k'}| \;\Rightarrow\; \frac{|1/u'(w'_{k+1}) - 1/u'(w_k)|}{\eta(v'_{k+1})} \geq \frac{|1/u'(w'_{k'+1}) - 1/u'(w_{k'})|}{\eta(v'_{k'+1})}.$$

Proof. See Appendix A.1 □

At any state and for any cohort, wages adjust towards w_k^*. The target wage w_k^* will respond to productivity shocks and thus constantly fluctuate, affecting the movement of actual wages and guiding wage pass-through. To understand how the size and the selection channels lead to wage rigidity, I show how the target wage depends on the size and average productivity of cohorts.

Proposition 3. *For any state $(y, \{n_k, v_k, z_k\})$ and cohort k:*

1. *Target wage falls in response to any size state: $\dfrac{\partial w_k^*}{\partial n_{k'}} < 0$.*
2. *Target wage rises in response to own quality: $\dfrac{\partial w_k^*}{\partial z_k} > 0$.*
3. *Target wage (weakly) falls in response to other cohorts' quality: for all $k' \neq k$, $\dfrac{\partial w_k^*}{\partial z_{k'}} \leq 0$.*

Proof. See Appendix A.1. □

Target wage will respond to firm's choices of hiring new workers or actively retaining current ones via the DRS production function: the more workers the firm has, the less productive is the marginal worker, lowering the wage at which the firm would be indifferent about losing such worker. However, the size effect is generally similar across cohorts as it shows up similarly in the marginal productivity of any cohort. The only state variable having a notably stronger effect on the particular cohort's target wage w_k^* is its own average productivity z_k.

The only way to change productivity of a cohort is layoffs: by firing less productive matches the firm will raise the average productivity of the cohort, thus also raising their target wage. This in turn gives us the connection between layoffs and wage growth: layoffs s_k will trigger a rise in the corresponding target wage w_k^*. Then, to understand the heterogeneity of wage growth across cohorts, we need to understand when and whom do firms fire.

Layoffs Layoffs are the firm's only instrument to alter within-cohort quality; by item 2 of Proposition 3, they are also the only tool differentially moving target wages across cohorts. To understand the impact of layoffs on wage pass-through and its heterogeneity, I consider when and whom do firms fire.

Proposition 4. *Consider a state $(y, \{n_k, v_k, z_k\})$ and a cohort k with $z_k < 1$.*

Optimal layoffs satisfy

$$-E_{y'|y}\frac{\partial J'}{\partial n'_{k+1}}\big(1-p(v'_{k+1})\big)+E_{y'|y}\frac{\partial J'}{\partial z'_{k+1}}\frac{\partial z'_{k+1}}{\partial s_k}\frac{1}{n_k}-\frac{R(v'_{k+1})-U}{u'(w_k)}\ \leq\ 0,$$

with $s_k \geq 0$ and complementary slackness.

1. *When does firm fire?*
   Layoffs are more common in low productivity states. Consider a lower productivity state $(\underline{y}, \{n_k, v_k, z_k\}), \underline{y} < y$:

$$s_k(\underline{y},...) \geq s_k(y,...) \quad \forall k$$

2. *Who gets fired?*
   Layoffs follow a lexicographic rule:
   - *Bad matches are fired first*
   - *Within bad matches, cohorts with lower promised values are fired first*

Proof. See Appendix A.1. □

As with wages, layoffs trade off the marginal value of a worker, $E_{y'|y}[\partial J'/\partial n'_{k+1}]$, against the compensation cost $\big(R(v'_{k+1})-U\big)/u'(w_k)$. The distinctive term is the quality effect, $E_{y'|y}[\partial J'/\partial z'_{k+1}]\,(\partial z'_{k+1}/\partial s_k)/n_k$, since quality cannot be priced but can be *selected* via layoffs. I will now elaborate on how the layoffs connect to the wage rigidity and, furthermore, why is it the junior workers that get fired.

First, note that layoffs are inversely connected to productivity shocks: the lower is the productivity state y, the more the firm fires. Combined with the result 2 from Proposition 3 that layoffs raise target wage (by raising the average productivity of the cohort), this leads to downward wage rigidity: when a negative shock hits, firms fire bad matches and keep wages (relatively) high to retain the survivors.

Second, the connection between layoffs and rigid wages, while generally applicable through the DRS production function, is especially strong in the cohorts that actually suffer layoffs. The last part of the Proposition 4 shows which cohorts are the first to be fired. The lower-v cohorts are more exposed to layoffs regardless of quality (provided $z < 1$). Furthermore, due to the decreasing returns to scale production, it is not just the absolute promised value v that matters, but the relative one: if there are plenty of lower v bad matches to be fired, the firm will never reach the higher paid matches. This suggests that the lower value cohorts will suffer higher layoffs but, due to the increase in their target wage, smaller wage cuts than than the higher paid cohorts.

Finally, to map these results to tenure patterns, note that higher-tenure workers generally have higher promised values than juniors due to two results. First, firms would only hire workers at promised values $\tilde{v}$ where the marginal value of the worker is positive, meaning that the value at hiring is less than the target value: $\tilde{v} < v^*$. Otherwise, the firm would not want to hire at all. Second, due to wage backloading (Proposition 2, item 1), these new hires will experience both wage and value rising over time (main exception being a persistent negative productivity shock right after hiring). Then juniors, being owed less, are therefore more exposed to layoffs than seniors and, via the upward shift in their target wages induced by layoffs, experience smaller wage cuts (if any) than seniors.

2.5 Impact of Policies

I briefly discuss the impact of the two policies introduced into the model: statutory severance pay and minimum wage.

Firms have to offer tenure-specific payments sev_k at least as large as the statutory level $\underline{sev}_k$ that scales with worker tenure. I show that it is in fact optimal for firms to scale their severance pay with worker tenure. Therefore, unless exceptionally high, the statutory severance pay is not binding for firms and thus does not offer the alternative explanation for the high layoff rate of the juniors.

I show that the severance structure involves higher payments for higher paid workers.

Proposition 5. *For any state $(y, \{n_k, v_k, z_k\})$ and cohort k the severance payments are given by*

$$\frac{u'(b + sev_k)}{u'(w_k)} = 1 - \frac{\beta sev_k \frac{\partial p(\theta_{sev_k})}{\partial sev_k}}{1 - \beta(1 - p(\theta_{sev_k}))}$$
$$\theta_{sev_k} = \theta(arg \max_v [(1 - p(\theta_v))U(sev_k) + p(\theta_v)v])$$

Proof. See Appendix A.2. □

Note that, besides $u'(w_k)$, all the components of the severance payment are independent of both the firm state and the worker tenure. It is then immediate to notice that higher paid workers will have higher severance payments: as $\frac{1}{u'(w_k)}$ rises, the value to the firm of the severance payment goes up, while costs stay the same. Therefore, the firm will optimally choose to offer higher severance payments to higher paid workers. Lastly, senior workers are generally on higher pay than more junior workers and thus will enjoy higher severance pay upon layoffs. The question of the comparison between the optimal value that the firms might offer and the mandated one is quantitative, not qualitative.

Minimum wage $\underline{w}$ has a direct impact on the downward wage rigidity of lower paid workers, generally juniors. Although my model does not require minimum wage to generate higher layoffs and lower wage pass-through of junior workers, it is crucial to distinguish between the of the two stories as they differ strongly in their implications. I leave the question of the size of the impact of both minimum wage and statutory severance pay to the quantification of the model.

2.6 Assumption discussion

I provide a brief discussion on the main assumptions of my model and their relevance for the mechanism.

On-the-job search On-the-job search is a crucial assumption of this model as it creates incentives for the firm to change workers' wages. If worker's on-the-job search decision was observable and, thus, directly contractible, the firm could offer the worker pay only for the on-path, preferred, search choice, and zero for everywhere else. At its very core, this is a classic dynamic moral hazard problem where the firm uses wages as a tool to control the worker's unobserved action. The introduction of risk-aversion alongside this unobservable action makes the core mechanism similar to that of Hopenhayn and Nicolini (1997), who design optimal unemployment insurance between a risk-neutral principal and the risk-averse worker with unobservable search effort.

Risk-aversion Risk-aversion is the key reason why the firm is keeping wages smooth. Absent risk-aversion, the moral hazard problem of the firm would become null as, even absent direct contractibility of search, the firm would be able to costlessly backload workers' wages so as to incentivize them to search exactly where the firm wants them to search. This is the case of Schaal (2017), where firm with decreasing returns to scale offers dynamic contracts to risk-neutral workers. Thanks to the risk-neutrality assumption, the firm optimization problem becomes equivalent to maximizing the total surplus of the firm and all its workers. However, in such a model, exactly because wages are so flexible, they are undetermined.

Decreasing returns to scale Absent decreasing returns to scale, there would not be wage rigidity generated through changes in firm size, as discussed in the previous section. Furthermore, decreasing returns to scale provide the model with additional structure for comparison across workers and firms. DRS provide the implications for layoffs and wage pass-through not just across tenure at the firm, but *seniority* – the relative position of the worker at the firm. This is consistent with the last-in-first-out layoff structure (LIFO), documented in Buhai et al. (2014).

Asymmetric information and no-wage-discrimination Firms privately observe each worker's match quality and do not disclose it. As shown in a simplified version of the model in Appendix A.3, non-disclosure—and the associated absence of wage discrimination within a contract—can arise endogenously as a pooling outcome.

First, a clarification is in order. The model does not require match quality to be completely unobserved by workers: it is enough that workers observe it only imperfectly at hiring. Likewise, allowing for observable worker heterogeneity is compatible with the mechanism; I abstract from these extensions for simplicity.

This informational friction disciplines both the layoff and wage-setting margins in a way that is consistent with the data. Under complete information (or under a separating equilibrium in the larger signalling game), wages would reveal match quality and firms would destroy matches only when jointly inefficient, at odds with recent empirical and survey evidence on privately inefficient separations (Jäger, Schoefer, and Zweimüller 2022; Davis and Krolikowski 2025). By contrast, pooling aligns with firms' stated wage-cut versus layoff trade-off: fears of quits (alongside morale) are a central deterrent to wage cuts (Bertheau et al. 2025), a concern that would be muted if firms could openly tailor wages to match quality.

One contribution of the paper is to show that even a relatively fine form of pooling—within cohort, across unobservable match quality—can still generate substantial layoffs. The tenure-specific wage pass-throughs documented in the next section suggest that this granularity is broadly consistent with what we see in the data; with more aggregate pooling, such heterogeneity would be difficult to obtain. This granularity also matters for policy: as I show in Section 4, broader and less targeted wage rigidities (e.g., minimum-wage floors) have much weaker effects on firms' hiring and firing incentives.

3 Empirical evidence

I document the relationship between layoffs and wage cuts using French matched employer–employee data. I examine how layoff rates and the wage pass-through of firm-level productivity shocks vary across firms and across worker tenure, and find substantial heterogeneity along both dimensions. I also find that workers' wages rise in response to layoffs of other workers' in their cohort, and that the cross-tenure wage gap shrinks in response to layoffs. These facts validate the qualitative predictions of my model.

3.1 Institutional Context of the French Labor Market

Relative to other advanced economies, France's labor market combines high coverage of collective agreements with low union density, a national minimum wage indexed to inflation, and moderate-to-strong employment protection in international comparison (OECD and AIAS/ICTWSS 2025; OECD 2020). Compared with the United States, France features substantially less decentralized wage setting and stronger wage floors; compared with Denmark, where the survey by Bertheau et al. (2025) was conducted, France relies more on sectoral wage grids and statutory floors, with lower job-to-job mobility and stricter dismissal rules on average (OECD 2025b).

I focus on three French institutions that directly shape firms' trade-off between wage adjustments and layoffs: the high national minimum wage, sectoral bargaining and the extension of wage floors, and legal versus de-facto severance pay.

National minimum wage. France minimum wage is indexed to consumer prices (and, under conditions, to average hourly wages), revalued by government decree.[6] In comparative terms, the minimum wage sits high relative to the wage distribution and, during the 2021–2024 inflation episode, often *caught up* with negotiated or slightly-above-floor wages, expanding the share of workers affected (OECD 2025a; France Stratégie 2024). This makes the minimum wage a binding constraint primarily at the bottom of the distribution.

Implications for empirics. To avoid mechanical truncation of wage changes, I exclude observations less than 5% above the concurrent minimum wage in my specification. In Appendix B.2.1 I consider alternative minimum wage cutoffs. and find little difference in my results.

Sectoral bargaining and extended wage floors. Collective bargaining in France is organized mainly at the branche (sector) level. The Ministry of Labour frequently extends sectoral agreements to non-signatory firms, which keeps bargaining coverage very high despite low union density (OECD and AIAS/ICTWSS 2025). Sectoral agreements typically specify wage grids by occupation/qualification. Empirically, the lower rungs of many grids are anchored by the national minimum wage: when the minimum wage is revalued, the lowest steps can be temporarily overtaken and must be renegotiated to restore compliance (France Stratégie 2024; Langevin 2018). Recent monitoring also noted numerous branches with minima below the updated minimum wage pending revision, underscoring that sectoral floors rarely remain much above the statutory floor for long.[7]

[6] Legal basis and indexation details in Eurofound (2024).

[7] See, e.g., union monitoring note (Force Ouvrière 2025).

Implications for empirics. Removing observations near minimum wage also attenuates the binding force of sectoral floors in my analytical window. In interpreting wage pass-through, I thus treat sectoral bargaining as setting reference wage structures whose binding power is strongest at the bottom, rather than pervasive hard constraints in the middle of the distribution.

Separation rules and severance pay. Statutory severance for layoffs on open-ended contracts (CDI) follows a tenure-based formula (at least $\frac{1}{4}$ month per year up to 10 years, then $\frac{1}{3}$ per year thereafter), with possible top-ups from collective or firm agreements (Service-Public.fr 2025). In practice, *de-facto* payouts are often higher than the legal minimum due to negotiated arrangements: (i) *Rupture conventionnelle* (mutual termination) has been widely used since its introduction, with median indemnities exceeding the legal minimum and substantial dispersion across tenure and occupational groups (DARES 2022); (ii) *transactional* settlements attached to dismissals (used to reduce litigation risk) further raise realized payouts within tax/social thresholds.[8]

Implications for empirics and mechanism. I interpret this setting as indicative of high endogenous severance pay, initiated by firms. With this in mind, I do not take into account the legal severance pay costs in my empirical setting and instead ask whether the model endogenously delivers sufficiently large severance payments as part of the optimal contract.

3.2 Data

I use administrative data from France between 2009 and 2019. The four key variables for the analysis—wages, layoffs, productivity, and tenure—are either directly available or can be constructed given the richness of the data. I combine a worker panel from social-security records covering one-twelfth of the French labor force (providing wages, layoffs, and tenure) with annual firm balance-sheet data (providing productivity). For the sample, I focus on prime-age workers (25–55) in private-sector jobs with wages at least 5% above the national minimum wage at the time. The remaining sample contains 265,000 unique firms and 880,000 unique workers per year. I next describe how I construct the four key variables.

I measure labor productivity using value added per worker, as reported in the balance-sheet data. I model labor productivity y_{fst} at firm f in sector s at time t as

$$\log y_{fst} = \log a_t + \log b_{st} + \log x_{ft},$$

where a_t is the aggregate component, b_{st} is a sectoral component, and x_{ft} is a firm-level component. I residualize $\log y_{fst}$ on time dummies to extract the common time component,

[8] Administrative and legal syntheses referenced in (DARES 2022).

measure the sectoral component $\log b_{st}$ as the average productivity within a sector, and compute the firm component $\log x_{ft}$ as the residual. In what follows, I focus on firms' responses to the firm-specific component x_{fst} to abstract from broader general-equilibrium effects.

I measure wages as annual, CPI-adjusted labor earnings divided by days worked. Labor earnings are net of payroll taxes but pre–income tax, and include all forms of compensation (including bonuses and payments in kind) but exclude stock options. I residualize log wages on occupation, firm, and region dummies, as well as a quadratic in worker experience. I focus on job-stayer wage growth $\Delta \log w_{ift}$ for workers continuously employed at firm f in years $t-1$ and t. After computing growth rates for both productivity and wages, I trim the bottom and top 5% of each year's distributions.

I measure layoffs as breaks in employment spells of at least four weeks. The idea is that job-to-job transitions rarely entail long breaks, and given the low job-finding rate in France, recently laid-off workers are unlikely to find employment within a month. This is a standard approach in empirical work using matched employer-employee data, used to identify both layoffs and job-to-job transitions. Examples include Haltiwanger et al. (2018), Souchier (2022), and Bertheau and Vejlin (2025).

Lastly, workers' tenure at the firm is directly observed in the data. For the cross-tenure regressions, I focus on the first ten years of tenure; beyond that, differences across cohorts are small.

3.3 Wages and layoffs across firms

I begin by confirming the existing finding that firms exhibiting the most rigid wages lay off the most workers (see Ehrlich and Montes (2024)). To facilitate comparison, I group firms into terciles $d \in D$ based on their average layoff rates. For each group, I estimate the response of wage growth to firm productivity shocks. Define the growth rate of residualized wages for worker i in firm f between years $t-1$ and t as $\Delta \log w_{ift}$ and the growth rate of firm productivity as $\Delta \log(x_{ft})$. I estimate:

$$\Delta \log w_{ift} = \sum_{d \in D} \mathbf{1}\{f \in d\}\big(\alpha^d + \beta^d \,\Delta \log(x_{ft})\big) + \epsilon_{ift}.$$

Average layoff rates and estimated wage pass-throughs across firms are reported in Table 1. Firms in the low-layoff tercile raise wages by 1.7% in response to a 100% productivity shock. Firms in the middle tercile, with an average layoff rate of 1.5%, raise wages by 1.2%. Lastly, high-layoff firms, averaging 9.7% layoffs, reduce wages by 0.2% in response to a positive shock. For robustness, I consider additional controls: experience, firm, occupation, and

	Layoff rate	Wage change
Low layoff rate	0.05%	0.017***
		(0.0006)
Medium layoff rate	1.5%	0.012**
		(0.0008)
High layoff rate	9.7%	−0.002***
		(0.0006)

Table 1: Wage pass-through across firms. Data: DADS Panel + FARE, 2009–2019.

region fixed effects – in Appendix B.2.2.

These results show that firms laying off the largest share of workers also exhibit the least responsive—and even negatively responsive—wages. This pattern is consistent with both the classical account (firms resort to layoffs when they cannot cut wages) and the mechanism developed here.

3.4 Wages and layoffs across tenure

Beyond cross-firm heterogeneity, the connection between rigid wages and layoffs also appears within firms, across worker tenure. Prior work has documented heterogeneity in layoff rates (e.g., Buhai et al. (2014)). This paper is the first to document heterogeneity in wage pass-through.

Let workers' tenure be $ten \in T$, observed directly in the employer–employee data. Unlike the firm-level analysis, I consider each worker cohort up to five years of tenure. I run two regressions. First, analogous to the across-firm case, I estimate the response of wages to firm-level shocks across tenure:

$$\Delta \log w_{ift} = \sum_{ten \in T} \mathbf{1}\{ift \in ten\}\big(\alpha^{ten} + \beta^{ten}\,\Delta \log(x_{ft})\big) + \epsilon_{ift}. \tag{7}$$

Second, I estimate layoff rates using the individual layoff event EU_{ift} for worker i in firm f at year t:

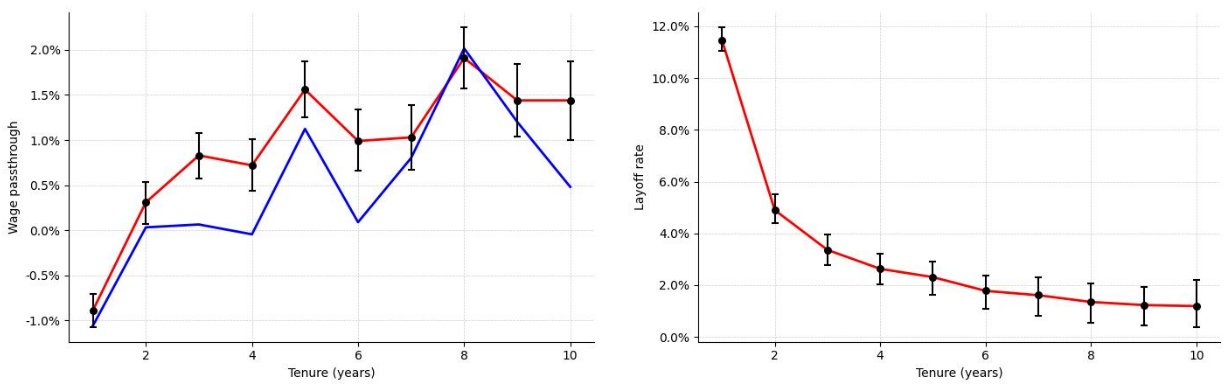
$$EU_{ift} = \sum_{ten \in T} \mathbf{1}\{ift \in ten\}\,\alpha^{ten} + \epsilon_{ift}.$$

I also examine asymmetry in pass-through. Negative productivity shocks are when firms are most inclined to use wage cuts and layoffs. Although downward wage rigidity is well established (e.g., Hazell and Taska (2021)), its heterogeneity across tenure is less explored. To estimate it, I modify (7) by interacting productivity growth with an indicator for negative shocks, letting $\Delta \equiv \Delta \log(x_{ft})$:

$$\Delta \log w_{ift} = \sum_{ten \in T} \mathbf{1}\{ift \in ten\} \Big(\alpha^{ten} + \beta^{ten} \Delta + \tilde{\beta}^{ten} \mathbf{1}\{\Delta < 0\} \Delta \Big) + \epsilon_{ift}.$$

Figure ?? reports the results. Junior workers exhibit the smallest average pass-through. At the same time, senior workers face layoff rates up to 5.5 times lower than juniors. Regarding downward rigidity, juniors benefit most: their response to positive shocks is largest, whereas their response to negative shocks is near zero. More senior cohorts display much less asymmetry in pass-through and are therefore more exposed to pay cuts than juniors. Same as for the results across firms, I consider additional explanatory variables in Appendix B.2.2.

I interpret these findings as evidence of a cohort-level trade-off between wage cuts and layoffs: whenever and wherever firms lay off workers, they cut survivors' wages less. The heterogeneous treatment of cohorts cannot be explained by standard stories of wage rigidity (minimum wages, sectoral bargaining, morale costs) without additional assumptions. Likewise, as discussed above, statutory severance payments in France rise only slightly with tenure.



(a) Wage pass-through across worker tenure.

(b) Annual layoff rate across worker tenure.

Figure 2: Wage pass-through and layoff rate across worker tenure. Points indicate estimates and the bars indicate 95% confidence intervals. For wage pass-through, red line indicates average response, blue line indicates response to negative productivity shocks.

3.5 Wage response to layoffs

I shift the angle of analysis and examine how wages respond to layoffs. I test two implications of my theory: that wages of survivors positively respond to layoffs (conditional on the productivity shock) and that wage gap between senior and junior workers shrinks after layoffs.

For each firm-year, I compute the average layoff rate EU_{ft} as well as the tenure-specific rate $EU_{ten,ft}$. I look at how individual wages change in response to these layoffs:

$$\Delta \log w_{ift} = EU_{ft} + EU_{ten,ft} + \epsilon_{ift}$$

Estimates appear in Table 3a. First column shows that, on average, workers' wages rise in response to layoffs. This is consistent with the workforce adjustment channel proposed in the model: layoffs improve average match quality, incentivizing the firm to offer higher wages to the survivors. Furthermore, the second column shows that this positive impact primarily comes through layoffs in own cohort: workers' wages rise in response to layoffs in own cohort but fall in response to layoffs elsewhere in the firm. This is consistent with wage pooling occurring at the cohort, rather than more aggregate, level, as is the case in the model.

Next, I consider how wage gap between junior and senior workers changes in response to layoffs. For each firm–year, I compute the median tenure and take the ratio of wages for workers above and below the median, $\bar{w}_{sen,f,t}/\bar{w}_{jun,f,t}$. I then compute the log change in this ratio over time and regress it on layoffs:

$$\Delta \log\big(\bar{w}_{sen,f,t}/\bar{w}_{jun,f,t}\big) = EU_{ft} + \epsilon_{ft}.$$

Table 3b reports the findings. On average, the wage ratio rises over time (likely reflecting new hires), but it falls when layoffs occur, suggesting that surviving juniors experience faster wage growth than surviving seniors. These results are consistent with the interpretation that firms lay off junior workers and then cut the wages of surviving juniors by less than those of surviving seniors.

	Wage Change	
EU_{ft}	0.049^{***}	-0.019^{***}
	(0.000)	(0.000)
$\mathrm{EU}_{ten,ft}$	x	0.071^{***}
	x	(0.000)

(a) Wage change in response to tenure-specific and firm-wide layoffs.

	Wage gap change
Intercept	0.0031^{***}
	(0.0001)
EU_{ift}	-0.0036^{***}
	(0.0006)

(b) Senior–junior wage log change in response to layoffs.

4 Quantitative Analysis

I calibrate the model using administrative data from France and assess whether it reproduces the empirical evidence on wage pass-through and layoffs across firms and tenure. I introduce

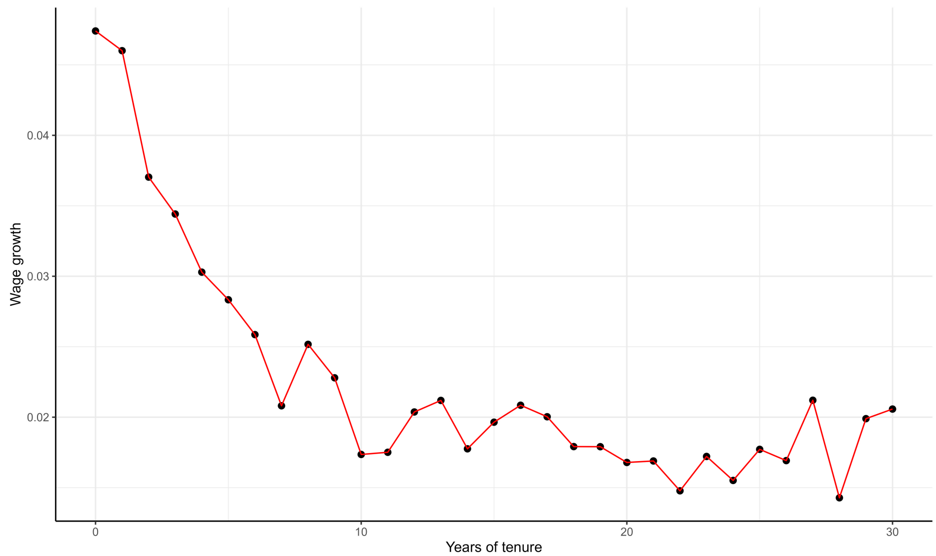


Figure 4: Wage growth across worker tenure

several policies prevalent in French labor market and use the model to assess their impact. I find that an exogenous source wage rigidity, minimum wage, has only a muted impact on hiring and layoff rates.

4.1 Solving the model

The tenure-based formulation yields a discrete—though expanding—state space. To make the problem fully tractable, I note that wages in contracts tend to converge, a result that follows from the propositions above. A corollary of Proposition 2 is that wages for cohorts with the same quality converge because they share the same target wage. I also expect quality across cohorts to converge.

The intuition for contracts converging is as follows. First of all, lower quality cohorts have lower target wages due not being as productive. Over time, due to tracking the minimum wage, the lower quality cohorts will also have a relatively lower value as compared to other, higher quality, cohorts. By Proposition 4, these cohorts are then more likely to suffer layoffs, thus catching up in quality to other cohorts. Now of higher average quality, these cohorts have a higher target wage and will thus catch up in wages and value over time.

Given convergence, the practical question is how quickly it occurs—or, equivalently, how many cohorts to track. Empirically, Figure 4 shows that CPI-adjusted log wage growth in France flattens after about ten years of tenure. I therefore restrict attention to a finite and constant $K \leq 10$ for all firms in the quantitative analysis. This is an approximation: as $K \to \infty$, the model converges to the problem in Lemma 2.

A second complication, common in dynamic-contract models, is the large action space because $\{v'_{y',k}\}$ grows with the number of productivity states. Appendix A.4 shows that the problem can be solved in its dual form by choosing future marginal utilities—constant across productivity realizations—instead of promised values.

Lastly, I solve for a block-recursive equilibrium. As shown in Appendix A.5, such an equilibrium exists when all new hires enter at the same promised value v_0; any additional value associated with higher submarkets v is paid as a sign-on wage. I set v_0 equal to the unemployment value U.

4.2 Model specification

For quantifying the model, I focus on the CRS version of the firm production function. I work at annual frequency: contracts in France are rarely updated more than once per year, which facilitates cohort tracking. I set the discount factor to $\beta = 0.96$, consistent with a 4% annual interest rate. I work with the logarithmic utility.

Production is a concave function of quality-adjusted quantity:

$$F(n, z) = [n\,(z + \alpha_z(1 - z))]^{\alpha}.$$

I set $\alpha = 1.0$, consistent with the CRS production. Idiosyncratic firm-level productivity y follows a uniform Markov process as in Balke and Lamadon (2022): with probability λ_y productivity is redrawn uniformly; otherwise it remains unchanged. I normalize the expected value of y to 1.

Matching follows a CES contact-rate function (as in Menzio and Shi (2011)):

$$p(\theta) = \theta\,[a^{\gamma}/(a^{\gamma} + \theta^{\gamma})]^{1/\gamma}, \qquad q(\theta) = [a^{\gamma}/(a^{\gamma} + \theta^{\gamma})]^{1/\gamma}.$$

I use a common estimate of the curvature $\gamma = 0.8$ and normalize the vacancy posting cost $c = 1$.

Minimum wage

I introduce national minimum wage directly into the baseline of the quantitative model. The intent is to control for the key source of exogenous wage rigidity, which is a potential alternative explanation for both rigid wage and layoffs, in France. In the policy analysis, I will discuss the relevance of the minimum wage for reconciling the data, and its impact, alongside other labor policies, on the economy. This leaves 10 parameters to be estimated with 10 moments in the data.

Moments	Data	Model
Rate of new hires	12.8%	12.2%
Annual separation rate of the bottom prod tercile	3.9%	3.6%
Annual separation rate of the top prod tercile	3.0%	2.8%
Annual job-to-job transition rate	6.3%	5.4%
Tenure profile of wages at 10 years	6.4%	6.2%
s.d. of firm productivity growth	0.39	0.30
Annual persistence of firm productivity	0.79	0.73
Ratio of minimum wage to mean wage	0.45	0.46

Table 2: Targeted moments in data vs. model

4.3 Moments of interest

I target four sets of moments: transition probabilities, wage growth, productivity dynamics, and firm dynamics. I proceed with an informal discussion of what moments influence which parameters most.

Transitions. I measure annual job-to-job (E2E) and unemployment-to-employment (U2E) transitions. For the hiring rate, I use the share of newly hired workers among all observations. U2E and E2E map directly to vacancy c and relative search of efficient of job-to-job transitioners, λ_{jj}, respectively. I obtain an E2E rate of 6.3% and a 12.8% share of new hires economy-wide.

Layoffs across productivity. I track the distribution of employment-to-unemployment (E2U) rates across firms by productivity. I separate firms into productivity terciles, and take average layoff rate from the top and bottom terciles. These moments discipline match-heterogeneity parameters: the lower the relative productivity of low-quality matches α_z, the more even highly productive firms will lay off workers. After sufficiently positive productivity shocks, firms hire; when q_0 (the share of high-quality new matches) is small, subsequent layoffs are more likely.

Wage growth by tenure. I use wage growth over the first ten years of tenure to discipline unemployment production b. Intuitively, wages rise until a cohort's marginal profit reaches zero; the lower the cohort's starting point (which depends on the unemployment outside option), the larger the initial wage growth. I document 6.1% wage growth after five years of tenure.

Productivity dynamics. I measure the standard deviation and persistence of firm-level productivity (net of aggregate and sectoral effects) to discipline productivity parameters λ_y

Parameters	Value	Parameters	Value
Unemployment production b	0.59	Share of high-quality matches z_0	0.57
Firm productivity persistence λ_y	0.95	Relative productivity α_z	0.50
Firm productivity variance σ_y	0.65	Minimum wage w_{min}	0.85
Matching efficiency α	0.72		
On-the-job search efficiency λ_{jj}	0.78		

Table 3: Estimated model parameters

and σ_y. Firm-level productivity is moderately persistent with coefficient 0.79. Its standard deviation is 0.39, the largest among productivity components, consistent with comparable estimates of 0.81 and 0.30 in Souchier (2022).

Firm dynamics. To discipline firm entry cost κ_e, I target a 6% share of jobs created by entering firms. Because fixed cost κ_f affects exit and thus selection, I target an average firm size of 32.5. For comparison, the average establishment size is 17.9, close to 15.6 in the 2002 U.S. Economic Census.

4.4 Model Fit

For the time being, I solve the model with constant returns to scale and estimate it via indirect inference. In this simplified specification, there is no need for firm entry and maintenance costs, and thus, the related moments are also not targeted.

The model fit, as shown in Table 2, can be improved. On the transition probabilities side, both the overall proportion of new hires and the proportion of the job-to-job transitioners fall under their empirical counterparts. On the other hand, the model overestimates the layoff rate occurring in the data, especially at the bottom tercile.

The model currently does not exhibit large enough wage growth, which, alongside the overestimated layoffs, suggests that the unemployment production b could be even lower.

Lastly, the standard deviation of firm productivity growth is notably undervalued. One possible explanation is that the relatively standard parameters values for the volatility of the firm shock that I employ are not large enough to overpower the smoothing effect that the layoffs have on the overall firm productivity.

Parameter Values The corresponding parameter values are presented in Table 3.

The fairly high tenure profile of wages suggests a low value of home production $b = 0.59$. This is above the values used in standard calibrated DMP models like Shimer (2005), but still notably below the calibration of Hagedorn and Manovskii (2008), and well in the range of

	Data		Model	
	Layoff rate	Avg. wage pass-through	Layoff rate	Avg. wage pass-through
<1 year	11%***	−0.008	5.80%***	−0.029***
1–2 years	5%***	0.004	0.70%***	0.013***
2–3 years	3%***	0.008**	0.40%***	0.009***
3–4 years	2%***	0.008*	0.20%***	0.019***
4–5 years	2%***	0.017***	0.10%***	0.019***

Table 4: Layoffs and wage pass-through across tenure in the simulated model.

values (47% to 96%) proposed by Chodorow-Reich and Karabarbounis (2016). This relatively low value also highlights that the model does not need the matches to be inefficient (that is, for match productivity to be below home production) in order to generate layoffs.

The firm productivity parameters are comparable to those in Balke and Lamadon (2022), which is unsurprising given that I am applying the same approach to generate firm productivity shocks. However, my model required a stronger variance in firm productivity, which comes down to two facts: first, unlike in their model, I only have a single source of productivity shocks, at the firm level; second, in my model, firms can endogenously adjust their productivity via layoffs, essentially smoothing the observed firm productivity process.

Both the matching efficiency, relative to the vacancy cost normalized to 1, and the on-the-job search efficiency values are similar to the calibration of Menzio and Shi (2011) for the case where match quality is only observed upon the match being formed, exactly consistent with the story of my model. Crucially, however, my model does not need neither exogenous job destruction nor high unemployment productivity to generate layoffs.

Lastly, the match heterogeneity parameters are closely comparable to those of Gregory, Menzio, and Wiczer (2021), who estimate a Menzio-Shi-like model of directed search with match heterogeneity and calibrate their model to match the proportion and moments (including layoff rates) of three types of workers observed in the data: the alphas, beta, and gammas. Curiously, although my model does not target the specific transition rates across match types, it arrives at extremely similar parameter values: the relative productivity of the low quality match $\alpha_z = 0.50$ falls right inbetween the relative productivities of the less productive types beta, 0.623, and gamma, 0.459. Even more surprisingly, the proportion of high quality matches $z_0 = 0.57$ is exactly equal to the proportion of workers of type alpha documented by Gregory, Menzio, and Wiczer (2021).

4.5 Untargeted moments

(a) Plot: average wage and promised value across worker tenure.

	Wages	Value v
Intercept	1.151***	25.897***
	(0.0000)	(0.0001)
Tenure	0.022***	0.121***
	(0.0000)	(0.0000)

(b) Regression: average wage and promised value across tenure

Figure 5: Wage growth and promised value (left) alongside regression summary (right).

I perform two exercises to validate my model.

I first confirm the conjecture that junior workers are on the lower wage and promised value than the more senior workers. This conjecture is important as my theory does not address heterogeneity across worker tenure directly, and instead only through the differences in the promised value and average quality across cohorts.

To test this, I measure the average wage and expected across worker tenure in my simulated panel. Figure 5a shows the wage and value profile and Table 5b shows the estimates of an OLS regression of wages and value on tenure. Both wages and worker promised value rise with worker's tenure at the firm, suggesting that the model's theoretical predictions across cohorts' values can be translated into predictions across worker tenure.

Second, I assess whether the model reproduces the heterogeneity in layoffs and wage pass-through across firms and tenure documented in Section 3. I perform the same regressions on my panel data as in the empirical section, estimating layoff rates and wage pass-through across groups of workers (based on tenure).

The results for heterogeneity across tenure are presented in Table 4. At the current stage, undervalues layoffs in general but overvalues the difference in layoffs across cohorts: juniors suffer a 2.5 times smaller layoff rate than in the data, while more senior workers suffer between 7-30 lower layoff rates.

On the wage pass-through side, the juniors show strongly negatively responsive wages, but wage pass-through of more senior workers is fairly comparable to the data.

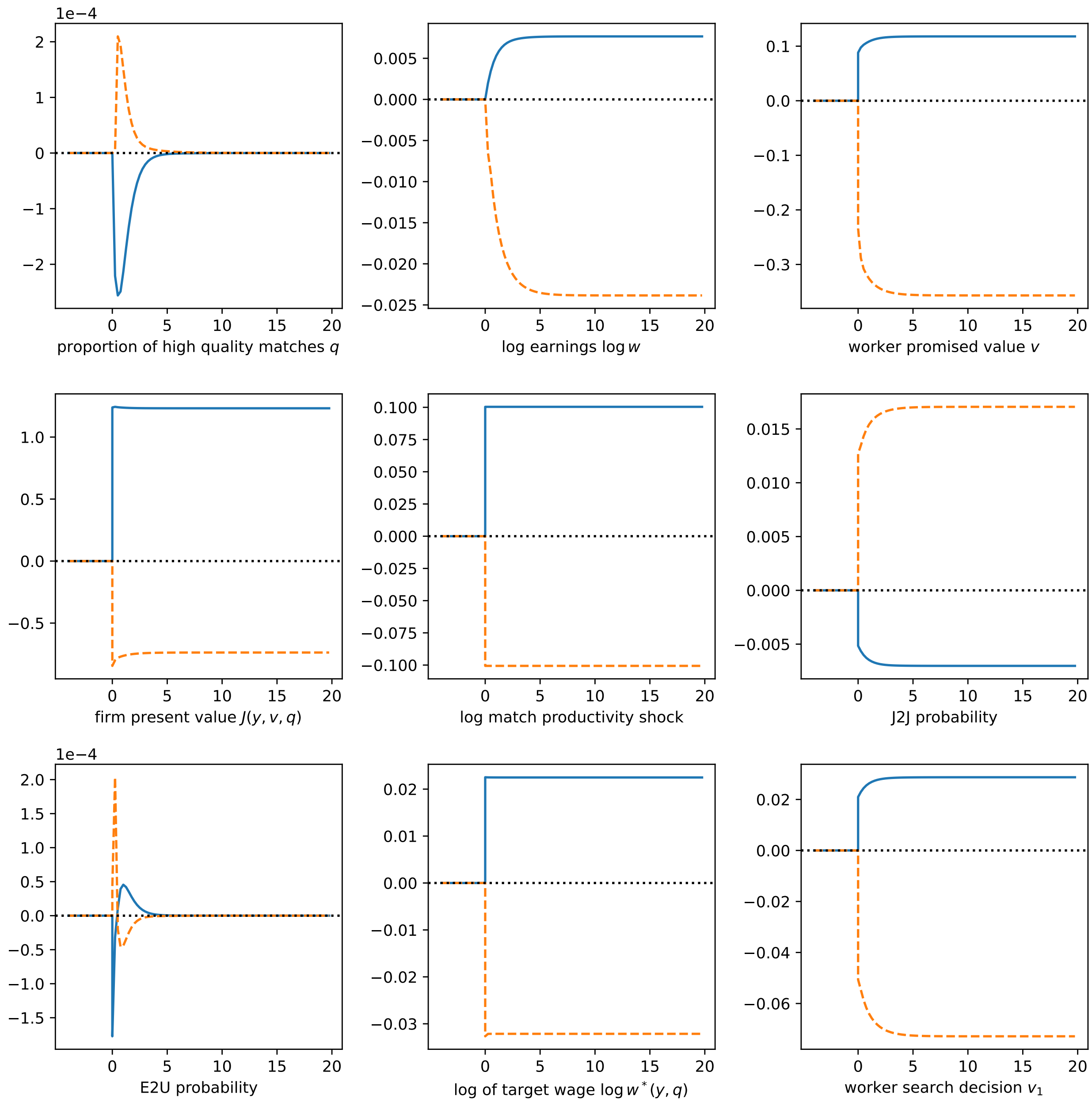


Figure 6: Impulse response to a permanent productivity shock. Blue represents a positive shock, orange – negative shock

4.6 Impulse response analysis

I report the impulse responses in the model to permanent positive and negative innovation shocks to firm productivity y, scaled to generate a 10% output change. In practice, I simulate the histories of a crossection of firms, and compare a treatment group that receives the permanent productivity shock with a control group that does not. Figures 6 and 7 report

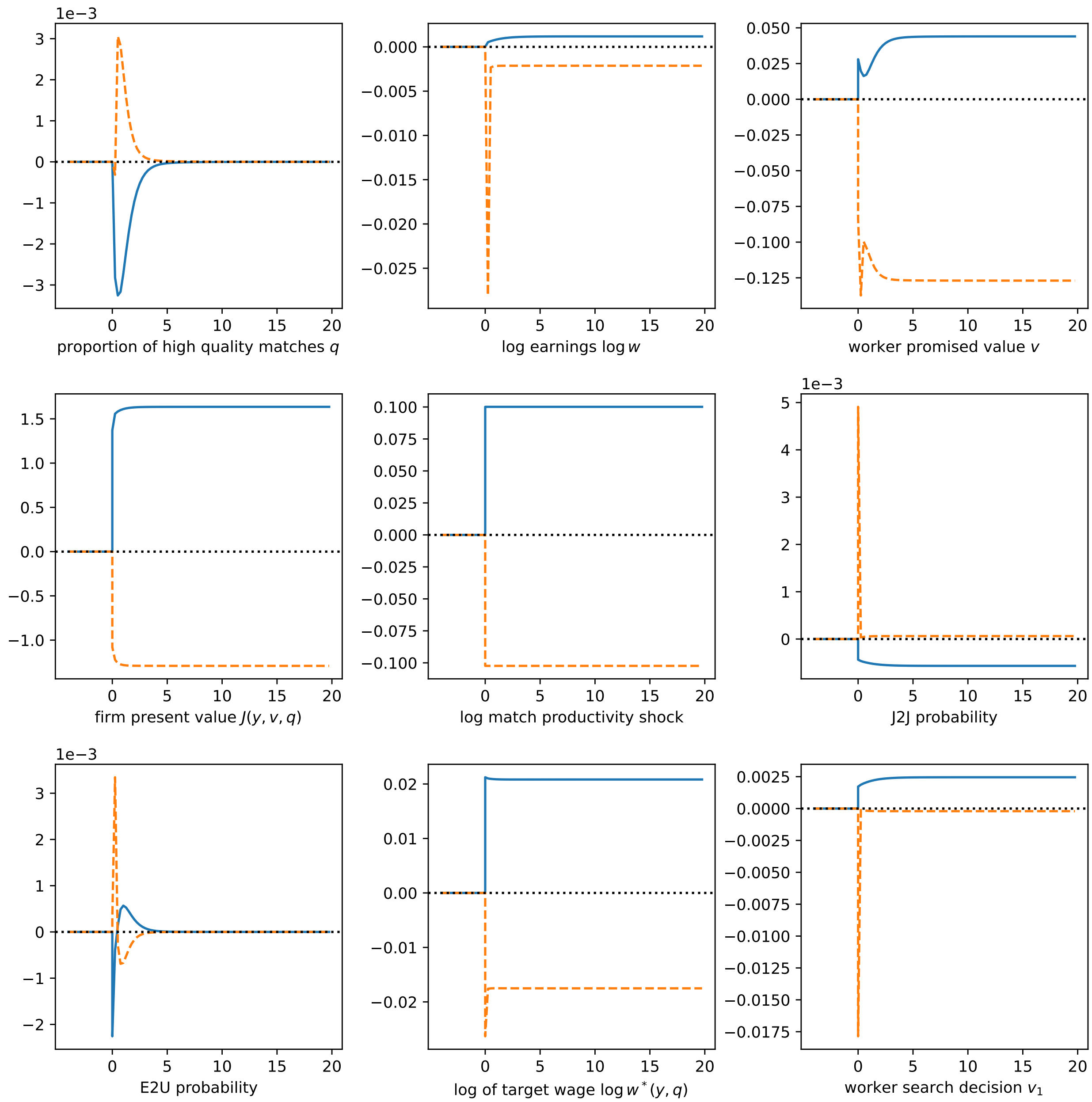


Figure 7: Impulse response to a permanent productivity shock, juniors only. Blue represents a positive shock, orange – negative shock

the differences in variables of interest between the control and treatment groups around the event at time 0. For each case, I simulated firms that existed at the last stage of the simulation that produced the results above. The Figure 6 show the average response across all such cohorts, and Figure 7 focuses on the cohorts the have just recently formed.

After a permanent positive shock to firm productivity, workers are immediately subjected to a fall in layoff risk and, with a delay, a hike in wages. However, the layoff rate change is minimal, as reflected in almost no change to the target wage $\log(w^*)$. Following a rise in wages, the job-to-job transition probability falls as workers are even less incentivized to find jobs elsewhere. The response to a negative shock, while generally the opposite of the response to a positive shock, differs slightly as a firm now has more "opportunity" to lay off poor matches. This is highlighted in the fact that the value of a marginal worker in the cohort changes by a notably smaller amount.

The impulse response for junior cohorts, shown in Figure 7, highlight the impact of layoffs much more starkly. Upon a negative productivity shock, the layoff rate spikes sharply enough that the impact is apparent in the target wage and all the related policies: upon layoffs, the wage arrives back to almost the original value, overall a much smaller wage drop than for seniors. This minimal impact on wages is highlighted also in the job-to-job transition probability of the worker that essentially does not change after the negative shock.

The effect of the permanent positive shock is similarly muted, due to the fact that quite a few of the low productivity junior matches that would have been fired otherwise, have been retain after the shock. This incentivizes the firm to not raise wages too much, as shown in the sudden fall in worker promised value v'.

4.7 Policy implications

I use my model as a realistic laboratory to evaluate the consequences of varying minimum wage and severance pay policies – two of the most important institutional features of European labor markets. In contrast to earlier models, the key difference in assessing these policies here lies in the endogeneity of wages, which makes it unclear whether the wage rigidity observed in the simulated data comes from the minimum wage or the firms' optimal choice not to cut wages. Similarly for severance pay, firms have incentives to offer their own severance, thus making the ultimate impact of statutory severance unclear.

4.7.1 Minimum Wage

Minimum wage is an important source of exogenous wage rigidity, particularly in France. In this section, I revisit two central questions about the minimum wage. First, using a counterfactual model without a minimum wage, I ask: What are the contributions of the current minimum wage to the wage and layoff ladders? What are its implications for productivity and firing decisions? What are the employment effects? Second, I examine the effects of a 20% increase in the minimum wage to address the question: Starting from an already high level—relative to the OECD average—what are the effects of raising the minimum wage even further? This question is particularly relevant if the minimum wage introduces convexities

	No min wage	Baseline	20% hike
Rate of new hires	12.8%	12.2%	11.2%
Annual separation rate of the bottom prod tercile	3.2%	3.6%	3.9%
Annual separation rate of the top prod tercile	2.5%	2.8%	3.0%
Annual job-to-job transition rate	5.2%	5.4%	5.5%

Table 5: Labor transition probabilities for different values of minimum wage.

in the model, whereby additional increases entail disproportionately large costs or gains for the economy.

Table 5 shows the employment transition moments in the economy across the three cases. Overall, the impact of minimum wage is rather muted. Without the minimum wage, the model still delivers almost the same rate of new hires as well as the layoff rate, but slightly underestimates the job-to-job transition rate. As I explain below, this is unsurprising. First, firms hire workers on promised values, not on wages. Although a minimum wage does make it less profitable to employ workers on the values, where this wage would be binding, ultimately the firms can still recoup some of the overdelivered value by not raising workers wages longer-term. This implies that the presence of minimum wage need not strongly affect the value of hiring workers. Second, firms primarily use layoffs to shed less productive matches. Although minimum wage does create cases where the firm may want to fire even more productive matches, those cases are rate Lastly, when the minimum wage binds for a cohort, the firm is forced to frontload the workers' utility. This results in workers being more incentivized to look for other jobs.

The impact of the 20% minimum wage hike is more pronounced, as the minimum wage now reaches even more productive workers and the firms are even further restricted in back-loading workers wages. Still, the effect is generally muted.

I next consider how the minimum wage affects the heterogeneity in wage pass-through and layoffs across worker tenure. I focus on the comparison between the case of no minimum wage and the baseline as the way to confirm that minimum wage is not essential in reconciling this heterogeneity. Generally, removing minimum wage dampens layoffs and amplifies wage pass-through. Still, the effect are small, suggesting that my model did not rely heavily on minimum wage to generate the heterogeneity.

4.7.2 Severance pay

The severance pay in the model is determined by the firm's endogenous severance pay choice. I discuss the realized severance pay in my model and compare it to the data.

	No min wage		Baseline		20% hike	
	Layoffs	Wages	Layoffs	Wages	Layoffs	Wages
<1 year	5.4%	0.012	5.80%	-0.029	6.00%	-0.057
1–2 years	0.6%	0.017	0.70%	0.013	0.73%	0.002
2–3 years	0.42%	0.023	0.40%	0.009	0.51%	0.008
3–4 years	0.15%	0.025	0.20%	0.019	0.26%	0.011
4–5 years	0.06%	0.025	0.10%	0.019	0.12%	0.016

Table 6: Layoffs and wage pass-through across tenure for different values of minimum wage.

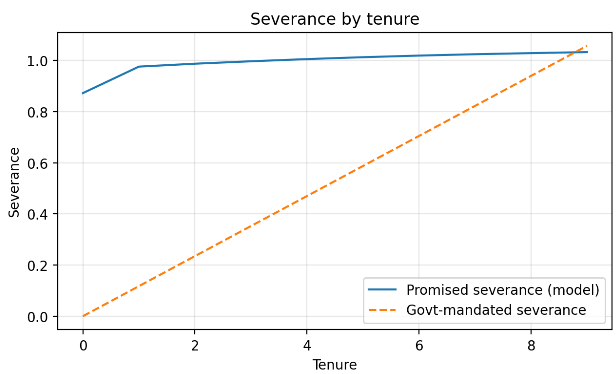


Figure 8: Severance pay across worker tenure.

Figure 8 shows the average severance pay across the first 10 years of worker tenure. Severance pay strongly increases in cohort's wage and is only bounded by the exogenous policy for the most senior workers. Even without any requirements, firms choose to provide workers with a significant severance pay in order to compensate workers for layoffs ex-post. Otherwise, absent severance, the ex-ante risk of layoffs would have to be compensated via higher average wage to all the workers.

The reason for why the optimal severance pay stagnates in tenure is that the optimal severance pay scales with worker wages: the more worker is paid, the more they lose from being laid off, the more the firm wants to compensate them with severance. However, as wage growth stagnates, so do the severance payments. In that sense, my model cannot reconcile the severance pay above legal minima beyond the first ten years of tenure. Further factors beyond the scope of this paper, like human capital accumulation, may induce the firm to keep raising worker's value over the long-term by raising the severance pay.

5 Conclusion

This paper proposes a new perspective on the relationship between wage rigidity, layoffs, and employment fluctuations. I develop an equilibrium search model with one-sided limited commitment and asymmetric information about match quality, in which firms optimally choose both wage paths and layoff policies without discriminating in wages within a contract. In this framework, layoffs and rigid wages arise endogenously and are correlated across workers, firms, and tenure—not because rigid wages mechanically force firms to fire, but because layoffs are a tool for managing workforce composition. Negative productivity shocks lead firms to shed low-quality matches and protect the wages of the remaining workers they most wish to retain. Using matched employer–employee data from France, I show that this mechanism is consistent with the joint behavior of wages and layoffs across firms and across tenure: the firms that fire the most have the most rigid wages, and junior workers face higher layoff risk but weaker wage pass-through than senior workers.

Quantifying the model reveals that this mechanism also matters for how we interpret labor market policies. Once firms' endogenous incentives to smooth wages and to use layoffs to reallocate workers are accounted for, a sizable increase in the minimum wage has only a limited impact on layoffs and job-finding rates, and removing the minimum wage does little to alter the heterogeneity of wage and layoff responses across tenure. Allowing firms to choose severance pay in the model further shows that generous, tenure-dependent severance can be an optimal response to layoff risk rather than simply a constraint on firing, effectively making layoffs cheaper by improving risk-sharing. Together, these results suggest that focusing exclusively on downward wage rigidity as a constraint on firms' decisions misses a central margin of adjustment: firms' active use of layoffs and wage smoothing as joint instruments for managing their workforce.

References

1. Acemoglu, Daron and William B. Hawkins (2014). "Search with multi-worker firms". In: *Theoretical Economics* 9.3, pp. 583–628. URL: https://econtheory.org/ojs/index.php/te/article/view/20140583/0.

2. Balke, Neele and Thibaut Lamadon (2022). "Productivity shocks, long-term contracts, and earnings dynamics". In: *American Economic Review* 112.7, pp. 2139–2177.

3. Barro, Robert J. (1977). "Long-term contracting, sticky prices, and monetary policy". In: *Journal of Monetary Economics* 3.3, pp. 305–316. ISSN: 0304-3932. DOI: https://doi.org/10.1016/0304-3932(77)90024-1. URL: https://www.sciencedirect.com/science/article/pii/0304393277900241.

4. Berger, David (2011). "Countercyclical Restructuring". In.

5. Bertheau, Antoine and Rune Vejlin (2025). "Job ladders by firm wage and productivity". In: *Review of Economic Dynamics*, p. 101307.

6. Bertheau, Antoine et al. (2025). *Why Firms Lay Off Workers Instead of Cutting Wages: Evidence from Linked Survey-Administrative Data*. eng. IZA Discussion Papers 17704. Bonn. URL: https://hdl.handle.net/10419/314601.

7. Bewley, Truman F (1999). *Why wages don't fall during a recession*. Harvard university press.

8. Bilal, Adrien et al. (2022). "Firm and worker dynamics in a frictional labor market". In: *Econometrica* 90.4, pp. 1425–1462.

9. Blanco, Andreas et al. (2025). "A Theory of Labor Markets with Inefficient Turnover". In.

10. Buhai, I Sebastian et al. (2014). "Returns to tenure or seniority?" In: *Econometrica* 82.2, pp. 705–730.

11. Burdett, Ken and Melvyn Coles (2003). "Equilibrium Wage-Tenure Contracts". In: *Econometrica* 71.5, pp. 1377–1404. DOI: https://doi.org/10.1111/1468-0262.00453. eprint: https://onlinelibrary.wiley.com/doi/pdf/10.1111/1468-0262.00453. URL: https://onlinelibrary.wiley.com/doi/abs/10.1111/1468-0262.00453.

12. Cho, In-Koo and David M. Kreps (May 1987). "Signaling Games and Stable Equilibria". In: *The Quarterly Journal of Economics* 102.2, pp. 179–221. ISSN: 0033-5533. DOI: 10.2307/1885060. eprint: https://academic.oup.com/qje/article-pdf/102/2/179/5441738/102-2-179.pdf. URL: https://doi.org/10.2307/1885060.

13. Chodorow-Reich, Gabriel and Loukas Karabarbounis (2016). "The Cyclicality of the Opportunity Cost of Employment". In: *Journal of Political Economy* 124.6, pp. 1563–1618. DOI: 10.1086/688876.

14. Christiano, Lawrence J., Martin Eichenbaum, and Charles L. Evans (2005). "Nominal Rigidities and the Dynamic Effects of a Shock to Monetary Policy". In: *Journal of Political Economy* 113.1, pp. 1–45. ISSN: 00223808, 1537534X. URL: http://www.jstor.org/stable/10.1086/426038 (visited on 10/06/2025).

15. DARES (2022). *Les ruptures conventionnelles en 2021 — tableaux statistiques*. Ministère du Travail. URL: https://dares.travail-emploi.gouv.fr/sites/default/files/6149b3a47d8f40a443553b3cc0516bcd/DR_Ruptures%20Conventionnelles_.pdf (visited on 10/16/2025).

16. Davis, Steven J. and Pawel M. Krolikowski (2025). "Sticky Wages on the Layoff Margin". In: *American Economic Review* 115.2, pp. 491–524. DOI: 10.1257/aer.20240309. URL: https://www.aeaweb.org/articles?id=10.1257/aer.20240309.

17. Dias, Daniel A., Carlos Robalo Marques, and Fernando Martins (2013). "Wage rigidity and employment adjustment at the firm level: Evidence from survey data". In: *Labour Economics* 23, pp. 40–49. ISSN: 0927-5371. DOI: https://doi.org/10.1016/j.labeco.2013.02.001. URL: https://www.sciencedirect.com/science/article/pii/S0927537113000146.

18. Ehrlich, Gabriel and Joshua Montes (2024). "Wage Rigidity and Employment Outcomes: Evidence from Administrative Data". In: *American Economic Journal: Macroeconomics* 16.1, pp. 147–206. DOI: 10.1257/mac.20200125. URL: https://www.aeaweb.org/articles?id=10.1257/mac.20200125.

19. Elsby, Michael W L and Axel Gottfries (Sept. 2021). "Firm Dynamics, On-the-Job Search, and Labor Market Fluctuations". In: *The Review of Economic Studies* 89.3, pp. 1370–1419. ISSN: 0034-6527. DOI: 10.1093/restud/rdab054. eprint: https://academic.oup.com/restud/article-pdf/89/3/1370/43745381/rdab054.pdf. URL: https://doi.org/10.1093/restud/rdab054.

20. Elsby, Michael W. L. and Ryan Michaels (2013). "Marginal Jobs, Heterogeneous Firms, and Unemployment Flows". In: *American Economic Journal: Macroeconomics* 5.1, pp. 1–48. DOI: 10.1257/mac.5.1.1. URL: https://www.aeaweb.org/articles?id=10.1257/mac.5.1.1.

21. Elsby, Michael W. L et al. (2024). *Wage Adjustment in Efficient Long-Term Employment Relationships*. Working Paper 33149. National Bureau of Economic Research. DOI: 10.3386/w33149. URL: http://www.nber.org/papers/w33149.

22. Eurofound (2024). *Minimum wage in France (SMIC)*. URL: https://www.eurofound.europa.eu/en/countries/france/minimum-wage (visited on 10/16/2025).

23. Force Ouvrière (2025). *Salaires : 41% des branches toujours non conformes*. URL: https://www.force-ouvriere.fr/salaires-41-des-branches-toujours-non-conformes (visited on 10/16/2025).

24. France Stratégie (2024). *Rapport annuel du groupe d'experts sur le SMIC 2024*. France Stratégie. URL: https://www.strategie-plan.gouv.fr/files/2025-02/smic-rapport-2024-11decembre15h45_vdef_complet.pdf (visited on 10/16/2025).

25. Fukui, Masao (2020). "A theory of wage rigidity and unemployment fluctuations with on-the-job search". In: *Job Market Paper, Massachusetts Institute of Technology*.

26. Gregory, Victoria, Guido Menzio, and David Wiczer (2021). *The Alpha Beta Gamma of the Labor Market*. Working Papers 2021-003. Federal Reserve Bank of St. Louis.

27. Guiso, Luigi and Luigi Pistaferri (2020). "The insurance role of the firm". In: *The Geneva Risk and Insurance Review* 45.1, pp. 1–23.

28. Gulyas, Andreas (2020). *Firm Dynamics With Labor Market Sorting*. Tech. rep. University of Bonn and University of Mannheim, Germany.

29. Guvenen, Fatih et al. (2017). "Worker Betas: Five Facts about Systematic Earnings Risk". In: *American Economic Review* 107.5, pp. 398–403. DOI: 10.1257/aer.p20171094. URL: https://www.aeaweb.org/articles?id=10.1257/aer.p20171094.

30. Hagedorn, Marcus and Iourii Manovskii (2008). "The cyclical behavior of equilibrium unemployment and vacancies revisited". In: *American Economic Review* 98.4, pp. 1692–1706.

31. Haltiwanger, John C. et al. (2018). "Cyclical Job Ladders by Firm Size and Firm Wage". In: *American Economic Journal: Macroeconomics* 10.2, 52–85. DOI: 10.1257/mac.20150245. URL: https://www.aeaweb.org/articles?id=10.1257/mac.20150245.

32. Harris, Milton and Bengt Holmstrom (1982). "A Theory of Wage Dynamics". In: *The Review of Economic Studies* 49.3, pp. 315–333. URL: https://EconPapers.repec.org/RePEc:oup:restud:v:49:y:1982:i:3:p:315-333..

33. Hazell, Jonathon and Bledi Taska (2021). *Downward rigidity in the wage for new hires*. URL: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3728939.

34. Hopenhayn, Hugo A. and Juan Pablo Nicolini (1997). "Optimal Unemployment Insurance". In: *Journal of Political Economy* 105.2, pp. 412–438. ISSN: 00223808, 1537534X. URL: http://www.jstor.org/stable/10.1086/262078.

35. Jäger, Simon, Benjamin Schoefer, and Josef Zweimüller (Aug. 2022). "Marginal Jobs and Job Surplus: A Test of the Efficiency of Separations". In: *The Review of Economic Studies* 90.3, pp. 1265–1303. ISSN: 0034-6527. DOI: 10.1093/restud/rdac045. eprint: https://academic.oup.com/restud/article-pdf/90/3/1265/50212183/rdac045.pdf. URL: https://doi.org/10.1093/restud/rdac045.

36. Kaas, Leo and Philipp Kircher (2015). "Efficient Firm Dynamics in a Frictional Labor Market". In: *American Economic Review* 105.10, pp. 3030–60. DOI: 10.1257/aer.20131702. URL: https://www.aeaweb.org/articles?id=10.1257/aer.20131702.

37. Keynes, J. M. (1936). *The General Theory of Employment, Interest and Money*. 14th edition, 1973. Macmillan.

38. Kramarz, Francis and Marie-Laure Michaud (2010). "The shape of hiring and separation costs in France". In: *Labour Economics* 17.1, pp. 27–37. ISSN: 0927-5371. DOI: https://doi.org/10.1016/j.labeco.2009.07.005.

39. Langevin, Gabin (2018). *La conformité au Smic des minima de branches s'est-elle améliorée en 10 ans ?* DARES Analyses No. 005. URL: https://dares.travail-emploi.gouv.fr/publications/la-conformite-au-smic-des-minima-de-branches-s-est-elle-amelioree-en-10-ans (visited on 10/16/2025).

40. Malgieri, Cedomir and Luca Citino (2024). "Wage Contracts and Financial Frictions". In.

41. McCrary, Sean (2022). "A Job Ladder Model of Firm, Worker, and Earnings Dynamics". In: *Worker, and Earnings Dynamics (November 4, 2022)*.

42. Menzio, Guido and Shouyong Shi (2011). "Efficient search on the job and the business cycle". In: *Journal of Political Economy* 119.3, pp. 468–510.

43. Moen, Espen R (1997). "Competitive search equilibrium". In: *Journal of political Economy* 105.2, pp. 385–411.

44. Nekarda, CHRISTOPHER J. and VALERIE A. Ramey (2020). "The Cyclical Behavior of the Price-Cost Markup". In: *Journal of Money, Credit and Banking* 52.S2, pp. 319–353. DOI: https://doi.org/10.1111/jmcb.12755. eprint: https://onlinelibrary.wiley.com/doi/pdf/10.1111/jmcb.12755. URL: https://onlinelibrary.wiley.com/doi/abs/10.1111/jmcb.12755.

45. OECD (2020). *OECD Indicators of Employment Protection: Database and Documentation*. URL: https://www.oecd.org/en/data/datasets/oecd-indicators-of-employment-protection.html (visited on 10/16/2025).

46. — (2025a). *Low-wage employment in France*. OECD. URL: https://www.oecd.org/content/dam/oecd/en/publications/reports/2025/01/low-wage-employment-in-france_ac641c84/82539f44-en.pdf (visited on 10/16/2025).

47. — (2025b). *OECD Employment Outlook 2025*. OECD Publishing. URL: https://www.oecd.org/en/publications/2025/07/oecd-employment-outlook-2025_5345f034.html (visited on 10/16/2025).

48. OECD and AIAS/ICTWSS (2025). *France: Main indicators and characteristics of collective bargaining*. OECD/AIAS. URL: https://www.oecd.org/content/dam/oecd/en/data/datasets/oecd-aias-ictwss/France.pdf (visited on 10/16/2025).

49. Rudanko, Leena (2023). "Firm wages in a frictional labor market". In: *American Economic Journal: Macroeconomics* 15.1, pp. 517–550.

50. Schaal, Edouard (2017). "Uncertainty and unemployment". In: *Econometrica* 85.6, pp. 1675–1721.

51. Service-Public.fr (2025). *Dismissal allowance for employees on a permanent contract*. URL: https://www.service-public.fr/particuliers/vosdroits/F987?lang=en (visited on 10/16/2025).

52. Shimer, Robert (2005). “The cyclical behavior of equilibrium unemployment and vacancies”. In: *American economic review* 95.1, pp. 25–49.

53. Souchier, Martin (2022). *The pass-through of productivity shocks to wages and the cyclical competition for workers*. Tech. rep. Working Paper.

54. Sun, Yeneng and Yongchao Zhang (2009). “Individual risk and Lebesgue extension without aggregate uncertainty”. In: *Journal of Economic Theory* 144.1, pp. 432–443. ISSN: 0022-0531. DOI: https://doi.org/10.1016/j.jet.2008.05.001. URL: https://www.sciencedirect.com/science/article/pii/S0022053108000768.

55. Thomas, Jonathan and Tim Worrall (1988). “Self-Enforcing Wage Contracts”. In: *The Review of Economic Studies* 55.4, pp. 541–553. ISSN: 00346527, 1467937X. URL: http://www.jstor.org/stable/2297404 (visited on 10/06/2025).

A Model Appendix

A.1 Proofs

Proof of Proposition 1

Proof. Fix a state $\Omega = (y, \{n_k, v_k, z_k\}_{k \leq K})$ and consider the firm problem in Lemma 2. Let ρ_k be the multiplier on promise-keeping for cohort k and let ω_k be the multiplier on the constraint $v'_{k+1} = E_{y'|y} v'_{y',k+1}$.

Step 1: eliminate ρ_k using the FOC for w_k. The Lagrangian contains the term $-n_k w_k + \rho_k u(w_k)$. The FOC for w_k is

$$-n_k + \rho_k u'(w_k) = 0 \qquad \Rightarrow \qquad \rho_k = \frac{n_k}{u'(w_k)}.$$

Step 2: eliminate ω_k using the FOC for $v'_{y',k+1}$ and an envelope condition. Using the expectation constraint in Lemma 2, the Lagrangian contains $\omega_k\big(v'_{k+1} - E_{y'|y} v'_{y',k+1}\big)$. The FOC for $v'_{y',k+1}$ is, for each y',

$$\beta \Pr(y'|y) \frac{\partial J\big(y', \{n'_j, v'_{y',j}, z'_j\}\big)}{\partial v'_{y',k+1}} - \Pr(y'|y)\, \omega_k = 0,$$

so

$$\omega_k = \beta \frac{\partial J\big(y', \{n'_j, v'_{y',j}, z'_j\}\big)}{\partial v'_{y',k+1}} \qquad \forall y'.$$

By the envelope theorem for the promised-value state (the same argument as in your wage-growth derivation),

$$\frac{\partial J\big(y', \{n'_j, v'_{y',j}, z'_j\}\big)}{\partial v'_{y',k+1}} = -\frac{n'_{k+1}}{u'(w'_{k+1})}.$$

Therefore,

$$\omega_k = -\beta\, \frac{n'_{k+1}}{u'(w'_{k+1})}.$$

Step 3: use the FOC for v'_{k+1}. The choice v'_{k+1} affects the promise-keeping constraint through $R(v'_{k+1})$ and affects the continuation value through next-period cohort size $n'_{k+1} = n_k(1 - s_k)\big(1 - p(v'_{k+1})\big)$.[9] The FOC for v'_{k+1} is

$$\rho_k\, \beta(1 - s_k) R'(v'_{k+1}) + \omega_k + \beta\, E_{y'|y}\left[\frac{\partial J(\Omega')}{\partial n'_{k+1}}\right] \frac{\partial n'_{k+1}}{\partial v'_{k+1}} = 0.$$

By the envelope property of $R(\cdot)$, $R'(v'_{k+1}) = 1 - p(v'_{k+1})$. Also,

$$\frac{\partial n'_{k+1}}{\partial v'_{k+1}} = n_k(1 - s_k)\frac{\partial(1 - p(v'_{k+1}))}{\partial v'_{k+1}} = n'_{k+1}\, \eta(v'_{k+1}), \qquad \eta(v') \equiv \frac{\partial \log(1 - p(v'))}{\partial v'}.$$

Substituting $\rho_k = n_k/u'(w_k)$ and $\omega_k = -\beta n'_{k+1}/u'(w'_{k+1})$, we get

$$\beta\, \frac{n_k}{u'(w_k)}(1 - s_k)\big(1 - p(v'_{k+1})\big) - \beta\, \frac{n'_{k+1}}{u'(w'_{k+1})} + \beta\, n'_{k+1}\eta(v'_{k+1})\, E_{y'|y}\frac{\partial J(\Omega')}{\partial n'_{k+1}} = 0.$$

Using $n'_{k+1} = n_k(1 - s_k)(1 - p(v'_{k+1}))$ and dividing by $\beta n'_{k+1}$ yields

$$\frac{1}{u'(w'_{k+1})} - \frac{1}{u'(w_k)} = \eta(v'_{k+1})\, E_{y'|y}\frac{\partial J(\Omega')}{\partial n'_{k+1}},$$

which is (6). □

Proof of Corollary 1

Proof. Fix a next-period state $\Omega' = (y', \{n'_j, v'_{y',j}, z'_j\}_{j\le K+1})$ and a cohort index $k \le K$. Apply the envelope theorem to the Bellman equation in Lemma 2, differentiating the maximized value with respect to the state n'_{k+1} (holding the other state components fixed):

$$\frac{\partial J(\Omega')}{\partial n'_{k+1}} = \underbrace{\frac{\partial}{\partial n'_{k+1}}\Big(y' F(n'_H, n'_L)\Big)}_{\text{marginal product}} - \underbrace{w'_{k+1}}_{\text{marginal wage}} + \beta\, E_{y''|y'}\left[\frac{\partial J(\Omega'')}{\partial n''_{k+2}}\right],$$

[9] Cohort 0 is the newly hired group with $n'_0 = \tilde{n}$; for incumbents $k \le K$, their continuation mass is $n'_{k+1} = n_k(1 - s_k)(1 - p(v'_{k+1}))$.

where $n'_H \equiv \sum_j n'_j z'_j$, $n'_L \equiv \sum_j n'_j(1 - z'_j)$, and Ω'' is the optimal continuation state.

The marginal product term is

$$\frac{\partial}{\partial n'_{k+1}}\Big(y' F(n'_H, n'_L)\Big) = y'\Big(z'_{k+1} F_{n_H}(n'_H, n'_L) + (1 - z'_{k+1}) F_{n_L}(n'_H, n'_L)\Big).$$

Finally take $E_{y'|y}$ to match the statement in the corollary, and rewrite the marginal product as a "size effect" plus a "quality/composition effect" if desired (this is just an algebraic regrouping of the expression above). □

Proof of Proposition 2

Proof. Fix $\Omega = (y, \{n_j, v_j, z_j\}_j)$ and a cohort k. Holding Ω_{-k} fixed, vary only v_k and define $\Omega(v_k) \equiv (\Omega_{-k}, v_k)$. Let

$$\Phi_k(v_k) \equiv M_k(\Omega(v_k)) = \mathbb{E}_{y'|y}\left[\frac{\partial J(\Omega'(v_k))}{\partial n'_{k+1}}\right],$$

where $\Omega'(v_k)$ is the next-period state induced by the *optimal* policy from Lemma 2.

Existence and uniqueness. Continuity of the maximized value and of envelope objects implies $\Phi_k(\cdot)$ is continuous. For sufficiently low v_k, promise-keeping implies low compensation and retaining an additional worker is weakly profitable, so $\Phi_k(v_k) \geq 0$. For sufficiently high v_k, retaining an extra worker becomes costly, so $\Phi_k(v_k) \leq 0$. By the intermediate value theorem there exists v_k^* such that $\Phi_k(v_k^*) = 0$.

Moreover, $\Phi_k(v_k)$ is strictly decreasing in v_k: a higher promise tightens promise-keeping for cohort k and raises the marginal cost of retaining that cohort, lowering the marginal retention value. Hence the root v_k^* is unique. Let w_k^* be the wage associated with v_k^* as in Definition 1.

Part 1: wages move toward the target (no overshooting). Let $g(w) \equiv 1/u'(w)$; strict concavity of u implies g is strictly increasing. From Proposition 1,

$$g(w'_{k+1}) - g(w_k) = \eta(v'_{k+1})\, \Phi_k(v_k), \qquad \eta(\cdot) > 0.$$

Thus $\operatorname{sign}(w'_{k+1} - w_k) = \operatorname{sign}(\Phi_k(v_k))$. Since Φ_k is strictly decreasing with $\Phi_k(v_k^*) = 0$, we have: $v_k < v_k^* \Leftrightarrow \Phi_k(v_k) > 0$ and $v_k > v_k^* \Leftrightarrow \Phi_k(v_k) < 0$. Because promise-keeping implies $v_k \mapsto w_k$ is strictly increasing, the same ordering holds in wages.

To rule out overshooting, suppose $w_k < w_k^*$ but $w'_{k+1} > w_k^*$. Then the implied continuation promise is above target, hence $\Phi_k(\cdot) < 0$, which would force $g(w'_{k+1}) - g(w_k) < 0$, contradicting $w'_{k+1} > w_k$. The case $w_k > w_k^*$ is symmetric.

Part 2: farther from target implies faster adjustment (in $1/u'(w)$). Since Φ_k is strictly decreasing and crosses zero at v_k^*, $|\Phi_k(v_k)|$ is strictly increasing in $|v_k - v_k^*|$. Hence

$$|v_k - v_k^*| \geq |v_{k'} - v_{k'}^*| \quad \Rightarrow \quad |\Phi_k(v_k)| \geq |\Phi_{k'}(v_{k'})|.$$

Monotonicity of the promise-keeping map gives $|w_k - w_k^*| \geq |w_{k'} - w_{k'}^*| \Rightarrow |v_k - v_k^*| \geq |v_{k'} - v_{k'}^*|$, so

$$|w_k - w_k^*| \geq |w_{k'} - w_{k'}^*| \quad \Rightarrow \quad |M_k(\Omega)| \geq |M_{k'}(\Omega)|.$$

Finally, from Proposition 1,

$$\frac{\left|1/u'(w'_{k+1}) - 1/u'(w_k)\right|}{\eta(v'_{k+1})} = |M_k(\Omega)|.$$

Combining the two displays gives item (2). □

Proof of Proposition 3

Proof. Fix a state $\Omega = (y, \{n_j, v_j, z_j\}_j)$ and a cohort k. Let $v_k^*(\Omega_{-k})$ be the unique solution to $M_k(\Omega) = 0$ from Definition 1, and let w_k^* be the associated wage.

Step 1: reduce to signs of $\partial_\theta M_k(\Omega)$. For any scalar state component $\theta \in \{n_{k'}, z_{k'}\}$, the implicit function theorem gives

$$\frac{\partial v_k^*}{\partial \theta} = -\frac{\partial_\theta M_k(\Omega)}{\partial_{v_k} M_k(\Omega)}\bigg|_{v_k = v_k^*}.$$

At the target, $\partial_{v_k} M_k(\Omega) < 0$ (single-crossing from Proposition 2), and promise-keeping implies $v_k \mapsto w_k$ is strictly increasing. Hence

$$\operatorname{sign}\left(\frac{\partial w_k^*}{\partial \theta}\right) = \operatorname{sign}(\partial_\theta M_k(\Omega)).$$

So we sign $\partial_\theta M_k(\Omega)$.

Step 2: policy responses are inside M_k and do not create extra terms. By definition,

$$M_k(\Omega) = \mathbb{E}_{y'|y}\left[\frac{\partial J(\Omega')}{\partial n'_{k+1}}\right],$$

where Ω' is the next state induced by the firm's *optimal* policy at Ω. If θ changes, the firm re-optimizes; both Ω' and the shadow value $\partial J(\Omega')/\partial n'_{k+1}$ move. We do not compute derivatives of optimal policies. Instead, we use that $M_k(\Omega)$ is built from a *shadow value of an optimized problem.* Under concavity, shadow values inherit the relevant monotonicity properties even after re-optimization.

In particular, under Assumption **??**, an increase in any $n_{k'}$ weakly increases next-period effective inputs (n'_H, n'_L) along the re-optimized continuation path. With F strictly concave and increasing, this lowers marginal products of effective inputs and therefore lowers the shadow value of an additional worker. This is the mechanism behind (1). Similarly, increasing z_k raises the effective contribution of cohort k to (n'_H, n'_L) and raises the marginal product of a cohort-k worker; increasing $z_{k'}$ for $k' \neq k$ raises effective inputs through other cohorts and, under a standard substitutability curvature condition, weakly lowers cohort k's marginal product and hence its shadow value. These are the mechanisms behind (2)–(3). The formal signs follow below.

Step 3: Part (1), $\partial w_k^*/\partial n_{k'} < 0$. By Assumption **??**, increasing any $n_{k'}$ weakly increases (n'_H, n'_L) in the re-optimized continuation problem at each y'. Because F is strictly concave, both F_{n_H} and F_{n_L} strictly decrease when (n'_H, n'_L) increases. By Corollary 1, $\partial J(\Omega')/\partial n'_{k+1}$ is increasing in the marginal revenue product of a cohort-k worker and (given the optimized nature of J) cannot increase when all relevant marginal products fall. Therefore $\partial_{n_{k'}} M_k(\Omega) < 0$, so $\partial_{n_{k'}} w_k^* < 0$.

Step 4: Part (2), $\partial w_k^*/\partial z_k > 0$. Holding n_k fixed, increasing z_k increases cohort-k effective input $n_{H,k} = n_k z_k$ and decreases $n_{L,k} = n_k(1 - z_k)$. Since $F_{n_H} > F_{n_L}$, the marginal revenue product of a cohort-k worker increases. By Corollary 1, this raises $\partial J(\Omega')/\partial n'_{k+1}$ and hence raises $M_k(\Omega)$. Therefore $\partial_{z_k} M_k(\Omega) > 0$, implying $\partial_{z_k} w_k^* > 0$.

Step 5: Part (3), $\partial w_k^*/\partial z_{k'} \leq 0$ for $k' \neq k$. For $k' \neq k$, increasing $z_{k'}$ shifts other cohorts from low to high effective inputs. A convenient sufficient condition ensuring this weakly lowers the marginal revenue product of a cohort-k worker is the curvature ordering

$$F_{n_H n_H} \leq F_{n_H n_L} \leq F_{n_L n_L} < 0,$$

evaluated at the relevant (n'_H, n'_L). Under this restriction, increasing other cohorts' quality weakly decreases the weighted marginal product $z'_k F_{n_H} + (1 - z'_k) F_{n_L}$ of cohort-k labor. Corollary 1 then implies $\partial_{z_{k'}} M_k(\Omega) \leq 0$, so $\partial_{z_{k'}} w_k^* \leq 0$. □

Proof of Proposition 4

Proof. Fix a state $\Omega = (y, \{n_k, v_k, z_k\})$ and a cohort k with $z_k < 1$. Consider an interior choice $s_k \in (0, 1)$ such that the "bad-match margin" is active, i.e. $z'_{k+1} = z_k/(1 - s_k) < 1$ so that $\partial z'_{k+1}/\partial s_k > 0$.

Step 1: FOC for layoffs. From Lemma 2, s_k affects (i) next-period cohort mass $n'_{k+1} = n_k(1 - s_k)(1 - p(v'_{k+1}))$, (ii) next-period cohort quality $z'_{k+1} = z_k/(1 - s_k)$ (on the interior branch), and (iii) severance costs. Taking the FOC with respect to s_k and using $\rho_k = n_k/u'(w_k)$ from the FOC for w_k gives

$$-(1-p(v'_{k+1}))\,E_{y'|y}\frac{\partial J(\Omega')}{\partial n'_{k+1}} + \frac{1}{n_k}\,E_{y'|y}\frac{\partial J(\Omega')}{\partial z'_{k+1}}\,\frac{\partial z'_{k+1}}{\partial s_k} - \frac{R(v'_{k+1}) - U(sev_k)}{u'(w_k)} \;\leq\; 0,$$

with equality if $s_k > 0$ and complementary slackness at $s_k = 0$. This is the stated condition.

Step 2: layoffs are more common in low-y states. In the FOC above, lower y (in the current state) lowers continuation marginal values through the continuation problem, reducing $E_{y'|y}[\partial J(\Omega')/\partial n'_{k+1}]$ and $E_{y'|y}[\partial J(\Omega')/\partial z'_{k+1}]$ (diminishing returns). This makes the first two (benefit) terms smaller, so the inequality is easier to satisfy with a larger s_k. Thus optimal s_k is (weakly) higher when y is lower.

Step 3: bad matches fired first. This comes as an outcome of the fact that the bad matches are perpetually overpaid in the model and, on the other hand, the high quality matches are underpaid unless $z_k = 1$.
Essentially, for the high-quality matches the one direction of Coase theorem still applies: the firm will never fire the high quality matches unless the match surplus is below the unemployment value. However, the low quality matches will also get fired if they match surplus is negative, and, due to being less productive, they reach that threshold before the high quality matches do.

Step 4: lower promised values are more exposed to layoffs. Holding fixed continuation objects (v'_{k+1}, sev_k), the compensation term in the FOC is

$$\frac{R(v'_{k+1}) - U(sev_k)}{u'(w_k)}, \qquad w_k \text{ pinned down by } v_k = u(w_k) + \beta\big[s_k U(sev_k) + (1-s_k)R(v'_{k+1})\big].$$

Because u is increasing and strictly concave, w_k is strictly increasing in v_k, hence $1/u'(w_k)$ is strictly increasing in v_k. Therefore, as v_k increases, the compensation term rises, making layoffs less attractive at the margin. This yields the comparative static that lower-v cohorts are more exposed to layoffs.

□

A.2 Tenure-specific Severance Payments

I allow the firm to offer tenure-specific severance payments sev_k to its workers. The severance is constant over time and paid perpetually upon firing and before finding a new job. I show that the severance structure involves higher payments for longer tenured workers (if those workers are on a higher promised value).

Proof of Proposition 5

Proof. I start by describing the unemployment value of a worker with severance payment sev_k:

$$U(sev_k) = u(b + sev_k) + \beta \max_v [(1 - p(\theta_v))U(sev_k) + p(\theta_v)v]$$

Denote the probability of finding a job with severance payment sev_k as $p(\theta_{sev_k})$. The extra value to the unemployed from the severance payment is then given by

$$\frac{\partial U(sev_k)}{\partial sev_k} = u'(b + sev_k) + \beta(1 - p(\theta_{sev_k}))U'(sev_k) = \frac{u'(b + sev_k)}{1 - \beta(1 - p(\theta_{sev_k}))}$$

Then the total benefit to the firm from raising the severance payment is the slackening of the promised-keeping constraint thanks to this rise in the unemployment value:

$$\lambda_k n_k \beta s_k \frac{\partial U(sev_k)}{\partial sev_k} = \frac{n_k}{u'(w_k)} \beta s_k \frac{u'(b + sev_k)}{1 - \beta(1 - p(\theta_{sev_k}))}$$

On the cost side, the firm internalizes the net present value of the severance payments when firing $n_k s_k$ workers:

$$\frac{\partial}{\partial sev_k}\left[n_k s_k \beta \frac{sev_k}{1 - \beta(1 - p(\theta_{sev_k}))}\right] = n_k s_k \beta \frac{[1 - \beta(1 - p(\theta_{sev_k}))] - \beta sev_k \frac{\partial p(\theta_{sev_k})}{\partial sev_k}}{[1 - \beta(1 - p(\theta_{sev_k}))]^2}$$

The optimal severance payment then follows from the first-order condition:

$$\frac{n_k}{u'(w_k)} \beta s_k \frac{u'(b + sev_k)}{1 - \beta(1 - p(\theta_{sev_k}))} = n_k s_k \beta \frac{[1 - \beta(1 - p(\theta_{sev_k}))] - \beta sev_k \frac{\partial p(\theta_{sev_k})}{\partial sev_k}}{[1 - \beta(1 - p(\theta_{sev_k}))]^2}$$

Rearranging gives the result.

$$\frac{u'(b + sev_k)}{u'(w_k)} = 1 - \frac{\beta sev_k \frac{\partial p(\theta_{sev_k})}{\partial sev_k}}{1 - \beta(1 - p(\theta_{sev_k}))}$$

□

Note that, besides $u'(w_k)$, all the components of the severance payment are independent of both the firm state and the worker tenure. It is immediate to notice then that higher paid workers will have higher severance payments: as $\frac{1}{u'(w_k)}$, the value to the firm of the severance payment goes up, while costs stay the same. Therefore, the firm will optimally choose to offer higher severance payments to higher paid workers.

This equation is also easy to implement numerically: using the formulation in Appendix A.4, where $\rho_k \equiv u'(w_k)$ is a state variable, I can immediately compute the payments for all the firm states, before solving the rest of the firm problem.

A.3 Microfounding the Wage Noncontractability

In this subsection I show that, in a version of the model where the firm is allowed to choose worker-specific wages, there exists a pooling Perfect Bayesian Equilibrium (PBE) in which the firm does not use wages to signal individual match quality. Moreover, this pooling equilibrium survives the Intuitive Criterion of Cho and Kreps (1987).

I work with a simplified signalling game:

1. Time horizon is finite and consists of two periods $t = 1, 2$.
2. Workers choose search effort *before* layoffs are realized. This allows beliefs about layoff risk to affect period-1 search directly.
3. The production technology exhibits constant returns to scale, so the firm can treat each cohort independently, and I focus on a single cohort.
4. Idiosyncratic productivity shocks are shut down; they play no essential role in the signalling logic.

Match quality $z_i \in \{\underline{z}, \bar{z}\}$ is privately observed by the firm. The prior probability that a randomly drawn match is high quality is $z \equiv \Pr(z_i = \bar{z})$. A worker does not observe her individual z_i, but only holds a belief $\tilde{z}_i \in [0, 1]$ about it.

Wages are individually contractible and fully enforceable. By contrast, individual layoff risk is not verifiable and thus cannot be specified in a court-enforceable contract. The firm can commit to a worker-specific *wage path* (w_{i1}, w_{i2}), but not to a worker-specific layoff probability. Layoff decisions are taken ex post as in the baseline model, given the firm's information and the state of the cohort.

Definition 2 (Signalling version of the firm problem)**.** *Consider a firm managing a single cohort of mass n with average match quality z and promised utility v to each worker, as in Lemma 1.*

In the signalling version, the firm can offer worker-specific wage paths

$$(w_{i1}, w_{i2}) \in \mathbb{R}^2,$$

while the layoff rule remains contract-independent and follows the optimal layoff policy from Lemma 1. Let $s_z \in [0, 1]$ denote the period-2 layoff probability for a worker of type $z_i = z$ under that policy.

Given a wage path (w_{i1}, w_{i2}) and a belief $\tilde{z}_i$ about own match quality, worker i chooses search effort $\hat{v} \in V \subset \mathbb{R}_+$ to solve

$$\max_{\hat{v}\in V} \Big\{ u(w_{i1}) + \beta \Big[p(\hat{v})\,\hat{v} + (1-p(\hat{v}))\tilde{E}_{z_i}\left[s_z u(b) + (1-s_z)u(w_{i2}) \right] \Big] \Big\}, \tag{8}$$

where $p(\hat{v})$ is the job-finding probability and $\tilde{E}_{z_i}$ denotes expectation taken under the worker's subjective belief $\tilde{z}_i$ about own type.

The firm's value from a cohort when it can choose individual wages is given by

$$\begin{aligned} J(n, v, z) = \max_{\{w_{i1}, w_{i2}\}_{i\in[0,n]}} \Big\{ & n f(z) - \int_0^n \left[z_i w_{i1} + (1-z_i) w_{i1} \right] di \\ & + \beta \Big[n' f(z') - \int_0^{n'} \left[z_i' w_{i2} + (1-z_i') w_{i2} \right] di \Big] \Big\} \end{aligned} \tag{9}$$

subject to promised utility v in period 1 and the laws of motion

$$n' = n\Big[z(1-p(\tilde{v}'))(1-\bar{s}) + (1-z)(1-p(\tilde{v}'))(1-\underline{s}) \Big], \quad z' = \frac{nz(1-p(\tilde{v}'))(1-\bar{s})}{n'},$$

where $\tilde{v}'$ is the continuation value induced by the worker's search decision in (8) and the layoff policy.

Definition 3 (Pooling equilibrium of the signalling game)**.** *A* pooling equilibrium *of the signalling game is a PBE in which all workers in the cohort are offered the same wage path (w_1, w_2), independent of their individual match quality, and workers' beliefs do not infer additional information from wages on the equilibrium path.*

Formally, a pooling equilibrium consists of:

- *A wage policy (w_1, w_2) and a layoff policy $\{\bar{s}, \underline{s}\}$, applied uniformly to all workers in the cohort;*
- *A search policy $\hat{v}(w_1, w_2, \tilde{z}_i)$ for workers;*
- *A system of beliefs $\tilde{z}_i(w_{i1}, w_{i2})$ about own match quality following any observed wage path;*

such that:

1. ***Firm optimality:*** *Given the induced worker search decisions and beliefs, $(w_1, w_2, \bar{s}, \underline{s})$ solves the firm's problem (9) when the firm is restricted to offer the same wage path to every worker.*
2. ***On-path beliefs:*** *For any worker facing the equilibrium wage path (w_1, w_2), on-path beliefs coincide with the prior: $\tilde{z}_i(w_1, w_2) = z$.*

3. ***Off-path beliefs:*** *Following any off-equilibrium wage path* $(w_{i1}, w_{i2}) \neq (w_1, w_2)$*, beliefs* $\tilde{z}_i(w_{i1}, w_{i2})$ *are such that it is optimal for the firm not to deviate: the firm weakly prefers to continue offering the pooling wage path* (w_1, w_2) *to all workers.*

A pooling equilibrium survives the Intuitive Criterion *if the off-path beliefs satisfy the Intuitive Criterion of Cho and Kreps (1987) at all deviations.*

Define the elasticity of staying with respect to promised value v' as

$$\eta(v') \equiv \frac{\partial(1 - p(v'))/\partial v'}{1 - p(v')}.$$

Proposition 6. *There exists* $\bar{\eta} > 0$ *such that, if*

$$\eta(v') \leq \bar{\eta} \quad \textit{for all relevant } v',$$

then there is a pooling PBE of the signalling game in which all workers receive the same wage path (w_1, w_2) *independent of their individual match quality. This equilibrium survives the Intuitive Criterion.*

Proof. I first restrict attention to deviations in the wage path for a measure of workers of the particular quality, holding the layoff policy $\{\bar{s}, \underline{s}\}$ fixed. I then argue that allowing for changes in the aggregate layoff risk does not restore profitable deviations when η is small.

Step 1. Deviations that do not change workers' search decisions.

Fix a pooling equilibrium candidate with wage path (w_1, w_2) and induced search effort $\hat{v}^*$ under prior beliefs $\tilde{z}_i = z$. Consider a deviation by the firm for a single high-quality match, offering a different wage path (w_{i1}, w_{i2}) to worker i, while all other workers continue to receive (w_1, w_2).

Conditional on beliefs $\tilde{z}_i$, worker i chooses search effort $\hat{v}_i$ to solve (8). For any sufficiently small deviation (w_{i1}, w_{i2}) in a neighborhood of (w_1, w_2), continuity of the worker's best response implies that there exists a nonempty set of beliefs $B(w_{i1}, w_{i2})$ such that, for all $\tilde{z}_i \in B(w_{i1}, w_{i2})$, we have

$$\hat{v}_i(w_{i1}, w_{i2}, \tilde{z}_i) = \hat{v}^*.$$

For such beliefs, the firm cannot affect worker i's search probability $1 - p(\hat{v}_i)$ by deviating. The only effect of the deviation is then to change the intertemporal profile of wages for this worker, holding fixed (i) the probability that the worker stays with the firm and (ii) the layoff policy.

Because the worker is risk averse and the firm is risk neutral, the firm's dynamic contracting problem strictly prefers to smooth wages over time, subject to the same promised utility v (this is the usual insurance result that underpins Lemma 1). Therefore, conditional on keeping $\hat{v}_i = \hat{v}^*$, any deviation $(w_{i1}, w_{i2}) \neq (w_1, w_2)$ is weakly dominated by the pooling wage path in terms of the firm's expected profit. In particular, for any such small deviation there exist beliefs $\tilde{z}_i \in B(w_{i1}, w_{i2})$ such that the deviation is unprofitable.

Step 2. Application of the Intuitive Criterion for small deviations.

For these small deviations, both high- and low-quality matches can, in principle, benefit from deviating under some beliefs, since they share the same insurance motives. Hence no type can be ruled out as a potential deviator by the Intuitive Criterion at these deviations. The Intuitive Criterion therefore does not restrict off-path beliefs at small deviations, and it is legitimate to choose beliefs $\tilde{z}_i \in B(w_{i1}, w_{i2})$ that keep $\hat{v}_i = \hat{v}^*$. With such beliefs, the deviation is strictly unprofitable by the argument in Step 1. Thus no profitable small deviation exists.

Step 3. Large deviations and beliefs pinned down by the Intuitive Criterion.

Now consider larger deviations in the period-2 wage w_{i2} that are sufficiently generous to affect the worker's search decision regardless of beliefs. More precisely, define a threshold $\bar{w} > w_2$ such that, for any $w_{i2} > \bar{w}$ and any belief $\tilde{z}_i$,

$$\tilde{E}_{z_i}\big[s_z u(b) + (1 - s_z)u(w_{i2})\big] \geq E_z\big[s_z u(b) + (1 - s_z)u(w_2)\big],$$

so that the worker's continuation utility (if she stays) is at least as high as under the pooling contract for all beliefs. Under such deviations, the worker increases her search effort relative to $\hat{v}^*$ for any belief, and hence the probability of staying $(1 - p(\hat{v}_i))$ is reduced.

For deviations $w_{i2} > \bar{w}$, the Intuitive Criterion eliminates beliefs that put positive probability on types that could never gain from such a deviation. Under the maintained assumptions, low-quality matches benefit from pooling because pooling helps them hide among high-quality matches; retaining low-quality matches after a generous wage deviation is unprofitable. Hence large upward deviations in w_{i2} can only be profitable (if at all) for high-quality matches. The Intuitive Criterion therefore requires that, after observing such a generous deviation, workers put probability one on being a high-quality match:

$$\tilde{z}_i(w_{i1}, w_{i2}) = 1 \quad \text{for all } w_{i2} > \bar{w}.$$

Step 4. Profitability of large deviations when η is small.

It remains to show that, even under these optimistic off-path beliefs (workers infer that they are high-quality matches), such large deviations are not profitable for the firm when the elasticity of staying η is small.

Consider a deviation that changes the period-2 wage for a high-quality match by $\Delta w_2 > 0$, and lets the firm adjust the period-1 wage by Δw_1 so as to keep promised utility v fixed. Totally differentiating the firm's value with respect to w_2 around the pooling contract and using the envelope condition on the worker's problem yields

$$\frac{dJ}{dw_2} = -\frac{dw_1}{dw_2} \cdot \frac{1}{1-p(\hat{v})} \ + \ \beta\Big[-(1-p(\hat{v})) + (f'(\bar{z}) - w_2)\, \frac{d(1-p(\hat{v}))}{dw_2} \Big],$$

where $f'(\bar{z})$ is the marginal productivity of a high-quality match and $\hat{v}$ is the equilibrium search effort under the pooling contract.

Using the definition of the elasticity

$$\eta(\hat{v}) \equiv \frac{\partial(1-p(\hat{v}))/\partial\hat{v}}{1-p(\hat{v})} \quad \text{and} \quad \frac{d\hat{v}}{dw_2} > 0,$$

we can rewrite the last term as

$$\frac{d(1-p(\hat{v}))}{dw_2} = \eta(\hat{v})(1-p(\hat{v}))\frac{d\hat{v}}{dw_2}.$$

The first two terms,

$$-\frac{dw_1}{dw_2} \cdot \frac{1}{1-p(\hat{v})} \ - \ \beta(1-p(\hat{v})),$$

capture the pure insurance cost of shifting utility from period 2 to period 1, given risk-averse workers and a risk-neutral firm. This insurance cost is strictly negative and does not depend on η. The last term,

$$\beta(f'(\bar{z}) - w_2)\, \frac{d(1-p(\hat{v}))}{dw_2},$$

captures the incentive effect of altering the worker's search behavior. Its magnitude is proportional to $\eta(\hat{v})$.

Hence, for sufficiently small $\eta(\hat{v})$, the negative insurance term dominates the incentive term, and we obtain

$$\frac{dJ}{dw_2} < 0.$$

Intuitively, when the probability of staying is sufficiently inelastic with respect to promised value, the firm cannot induce enough additional separations of bad matches to offset the insurance cost of raising wages for workers who stay.

This shows that no large deviation in w_2 that survives the Intuitive Criterion (i.e., is interpreted as coming from a high-quality match) is profitable when η is small enough.

Step 5. Allowing deviations that also affect layoffs.

Finally, consider deviations in which the firm would also like to adjust layoff probabilities in period 2 in response to altered search behavior. In the present environment, layoffs are the firm's only instrument (other than workers' search) to get rid of bad matches. When η is small, even sizable changes in wages have only a limited effect on the ex ante composition of the cohort. To generate a meaningful reduction in the number of bad matches via worker search alone, the firm would need to choose very large wage deviations, which are exceedingly costly for insurance reasons as argued above.

Formally, any deviation that induces a significant change in the aggregate layoff risk must involve a change in w_2 large enough to render the pure insurance cost strictly larger in magnitude than the maximum gain from improved selection, given the bound on η. Therefore, under the same bound $\bar{\eta}$, there are no profitable deviations involving joint changes in wages and layoffs either.

Putting the steps together, I have shown that for sufficiently small elasticity $\eta(\cdot)$, there exists a pooling PBE in which the firm offers the same wage path (w_1, w_2) to all workers, and no deviation in wages (with or without induced changes in layoffs) is profitable once off-path beliefs are restricted by the Intuitive Criterion. This proves the proposition. $\square$

A.4 Recursive Lagrangian Approach

The original design of the problem would require solving promised values $v'_{y',k}$ for both each tenure step and each future productivity state. Following Balke and Lamadon (2022), I solve the following Pareto problem:

$$\begin{aligned}\mathcal{P}(y, \{n_k, \rho_k, z_k\}) = &\inf_{\omega_k} \sup_{\tilde{n}, \tilde{v}, \{w_k, s_k, v'_k\}} yF(n, z) - \sum_k n_k w_k - \kappa_f - \tilde{n}\frac{c}{q(\theta_{\tilde{v}})} \\ &+ \sum_k \rho_k (u(w_k) + \beta[s_k U + (1 - s_k)R(v'_{k+1})] \\ &- \beta \sum_k \omega_k v'_{k+1} + \beta E_{y'|y} \mathcal{P}(y', \{n'_k, \omega_k, z'_k\})\end{aligned}$$

where

$$\mathcal{P}(y, \{n_k, \rho_k, z_k\}) \equiv \sup_{\{v_k\}} J(y, \{n_k, v_k, z_k\}) + \sum_k \rho_k v_k$$

The following proof (for $K \to \infty$ but the proof extends trivially to finite K) establishes its equivalence with the initial problem. It follows the steps of Balke and Lamadon (2022), extending it to the case of a multi-worker firm.

Proof. We have the following recursive formulation for J:

$$J(y,\{n_k,v_k,z_k\}_{k\leq K}) = \max_{\tilde{n},\tilde{v},\{v'_k,v'_{y',k},w_k,s_k\}_{k\leq K}} yF(\sum_k n_k, \frac{\sum n_k z_k}{\sum n_k}) - \sum_k w_k n_k - \tilde{n}\frac{c}{q(\tilde{v})} - \kappa_f$$
$$+ \beta E_{y'|y} J(y',\{n'_k,v'_k,z'_k\}_{k\leq K+1})$$
$$(\lambda_k)\; u(w_k) + \beta[s_k U + (1-s_k)R(v'_{k+1}) = v_k] \;\forall k \leq K$$
$$(\omega_k) v'_{k+1} = E_{y'|y} v'_{k+1,y'} \;\forall k \leq K$$
$$n'_{k+1} = n_k(1-s_k)(1-p(v'_{k+1})) + \tilde{n} \;\forall k \leq K$$
$$z'_{k+1} = min(\frac{z_k}{1-s_k},1) \;\forall k \leq K$$
$$n'_0 = \tilde{n}, v'_0 = \tilde{v}, z'_0 = z_0$$

Consider the Pareto problem

$$\mathcal{P}(y,\{n_k,\rho_k,z_k\}) = \sup_{\{v_k\}} J(y,\{n_k,v_k,z_k\}) + \sum_k \rho_k v_k$$

I first substitute the definition of J together with its constraints into $\mathcal{P}$:

$$\mathcal{P}(y,\{n_k,\rho_k,z_k\}) = \sup_{\tilde{n},\tilde{v},\{v_k,v'_k,v'_{y',k},w_k,s_k\}_{k\leq K}} yF(\sum_k n_k, \frac{\sum n_k z_k}{\sum n_k}) - \sum_k w_k n_k - \tilde{n}\frac{c}{q(\tilde{v})} - \kappa_f$$
$$+ \beta E_{y'|y} J(y',\{n'_k,v'_k,z'_k\}_{k\leq K+1}) + \sum_k \rho_k v_k$$
$$(\lambda_k)\; u(w_k) + \beta[s_k U + (1-s_k)R(v'_{k+1}) = v_k] \;\forall k \leq K$$
$$(\omega_k)\; v'_{k+1} = E_{y'|y} v'_{k+1,y'} \;\forall k \leq K$$
$$n'_{k+1} = n_k(1-s_k)(1-p(v'_{k+1})) + \tilde{n} \;\forall k \leq K$$
$$z'_{k+1} = min(\frac{z_k}{1-s_k},1) \;\forall k \leq K$$
$$n'_0 = \tilde{n}, v'_0 = \tilde{v}, z'_0 = z_0$$

I now substitute in the promise-keeping constraint:

$$\mathcal{P}(y,\{n_k,\rho_k,z_k\}) = \sup_{\tilde{n},\tilde{v},\{v'_k,v'_{y',k},w_k,s_k\}_{k\leq K}} yF(\sum_k n_k, \frac{\sum n_k z_k}{\sum n_k}) - \sum_k w_k n_k - \tilde{n}\frac{c}{q(\tilde{v})} - \kappa_f$$
$$+ \beta E_{y'|y} J(y',\{n'_k,v'_k,z'_k\}_{k\leq K+1}) + \sum_k \rho_k (u(w_k) + \beta[s_k U + (1-s_k)R(v'_{k+1})])$$
$$(\omega_k)\; v'_{k+1} = E_{y'|y} v'_{k+1,y'} \;\forall k \leq K$$
$$n'_{k+1} = n_k(1-s_k)(1-p(v'_{k+1})) + \tilde{n} \;\forall k \leq K$$
$$z'_{k+1} = min(\frac{z_k}{1-s_k},1) \;\forall k \leq K$$
$$n'_0 = \tilde{n}, v'_0 = \tilde{v}, z'_0 = z_0$$

I introduce the ω_k-constraints with weights β into the problem:

$$
\begin{aligned}
\mathcal{P}(y,\{n_k,\rho_k,z_k\}) = \inf_{\{\omega_k\}} \sup_{\tilde{n},\tilde{v},\{v'_k,v'_{y',k},w_k,s_k\}_{k\leq K}} & yF(\sum_k n_k, \frac{\sum n_k z_k}{\sum n_k}) - \sum_k w_k n_k - \tilde{n}\frac{c}{q(\tilde{v})} - \kappa_f \\
& + \beta E_{y'|y} J(y',\{n'_k,v'_k,z'_k\}_{k\leq K+1}) + \sum_k \rho_k(u(w_k) + \beta[s_k U + (1-s_k)R(v'_{k+1})]) \\
& + \sum_k \beta\omega_k (E_{y'|y} v'_{y',k+1} - v'_{k+1}) \\
& n'_{k+1} = n_k(1-s_k)(1-p(v'_{k+1})) + \tilde{n} \ \forall k \leq K \\
& z'_{k+1} = min(\frac{z_k}{1-s_k}, 1) \ \forall k \leq K \\
& n'_0 = \tilde{n}, v'_0 = \tilde{v}, z'_0 = z_0
\end{aligned}
$$

I then rearrange the value function by moving $E_{y'|y}\sum_k \beta\omega_k n'_{k+1} v'_{y',k+1}$ (additional constraints are dropped to simplify notation):

$$
\begin{aligned}
\mathcal{P}(y,\{n_k,\rho_k,z_k\}) = \inf_{\{\omega_k\}} \sup_{\tilde{n},\tilde{v},\{v_k,v'_{y',k},w_k,s_k\}_{k\leq K}} & yF(\sum_k n_k, \frac{\sum n_k z_k}{\sum n_k}) - \sum_k w_k n_k - \tilde{n}\frac{c}{q(\tilde{v})} - \kappa_f \\
& + \beta E_{y'|y}[J(y',\{n'_k,v'_k,z'_k\}_{k\leq K+1}) + \sum_k \omega_k v'_{y',k+1}] \\
& \sum_k \rho_k(u(w_k) + \beta[s_k U + (1-s_k)R(v'_{k+1})]) - \sum_k \beta\omega_k v'_{k+1}
\end{aligned}
$$

Lastly, I split the sup:

$$
\begin{aligned}
\mathcal{P}(y,\{n_k,\rho_k,z_k\}) = \inf_{\{\omega_k\}} \sup_{\tilde{n},\tilde{v},\{v'_k,w_k,s_k\}_{k\leq K}} & yF(\sum_k n_k, \frac{\sum n_k z_k}{\sum n_k}) - \sum_k w_k n_k - \tilde{n}\frac{c}{q(\tilde{v})} - \kappa_f \\
& + \beta E_{y'|y}[\sup_{v'_{y',k+1}} J(y',\{n'_k,v'_k,z'_k\}_{k\leq K+1}) + \sum_k \omega_k v'_{y',k+1}] \\
& \sum_k \rho_k(u(w_k) + \beta[s_k U + (1-s_k)R(v'_{k+1})]) - \sum_k \beta\omega_k v'_{k+1}
\end{aligned}
$$

From this, one can note that, by definition of $\mathcal{P}$

$$
\sup_{v'_{y',k+1}} J(y',\{n'_k,v'_k,z'_k\}_{k\leq K+1}) + \sum_k \omega_k v'_{y',k+1} = \mathcal{P}(y',\{n'_k,\omega_k,z'_k\})
$$

We thus arrive to the formulationof the problem as described at the beginning, not involving finding future state-specific promised values $v'_{y',k}$. $\square$

A.5 Block Recursivity

I introduce an assumption that would allow for a block recursive eqiulibrium under the same conditions as in Schaal (2017). Block recursivity requires an indifference condition, either on the side of the firms or on the side of the workers. Under two-sided ex-post heterogeneity, that is not immediately achievable.

Schaal (2017) shows that, in a setting similar to mine, but with transferable utility between workers and firms, which he achieves due to the risk-neutral worker utility function, firms all have the same preferences across all the submarkets that they may post vacancies in. Define the minimal hiring cost as

$$k = \min_v [v + \frac{c}{q_v}]$$

Due to transferable utility, the cost of employing the worker from submarket v becomes simply the value v. Thus, the optimal entry of vacancies in Schaal (2017) can be summarized by

$$\theta_v [v + \frac{c}{q_v} - k] = 0$$

Meaning that either a submarket v minimizes the hiring cost or it is closed. This condition is completely independent of the distribution of firms and workers, exactly because the one component where the firm type might come through, the cost of employing a worker from submarket v, is completely independent from the firm's state due to transferable utility.

Utility is not transferable in my model, and thus different firms may face different costs of employing a worker at some value v (for example, fixing y and z, small firms prefer high values v due to their intention to upsize). To get around that, I split the value v that the worker would get upon getting hired into two components, the sign-on wage w_v and the remaining value v_0 such that

$$u(w_v) + \beta v_0 = v$$

This additional wage payment is incurred immediately upon hiring, allowing the remaining value that the firm owes to its worker, v_0, to be completely independent of the submarket v. Essentially, from the firm's perspective, submarkets now differ not in the value that firms would owe to the workers, but in this sign-on wage. The cost minimization problem then becomes

$$k = \min_v [w_v + \frac{c}{q_v}]$$

This problem is now again completely independent of the firm's state, and thus the distribution of firms and workers no longer affects the tightness function q_v.Schaal (2017) shows that, in a setting similar to mine, but with transferable utility between workers and firms, which he achieves due to the risk-neutral worker utility function, firms all have the same preferences across all the submarkets that they may post vacancies in. Then setting θ_v such that

B Data Appendix

I use administrative data provided by the CASD in France between 2009 and 2019. My analysis relies on two main files:

1. the panel version of the "DADS tous salariés" database, containing detailed information about employment history for 1/12th of the French population every year

2. "FARE" database, with annual information about firm balance sheet and income statement for the entire private sector except firms in the agricultural sector

I complement my analysis with the price index and national minimum wage provided by INSEE.

B.1 Asymmetric Wage Passthrough

Table 7 shows asymmetric response of wage to positive vs negative productivity shocks. Junior workers tend to have a much lower response to negative shocks than more senior workers, while still having a comparable response to positive shocks, suggesting that the heterogeneity in the average passthrough is primrily driven by smaller wage cuts to juniors.

	Layoff rate	Avg. wage pass-through	Response to pos. shock	Response to neg. shock
< 1 year	11%***	0.000	0.022***	0.002***
	(0.0002)	(0.004)	(0.004)	(0.003)
1–2 years	5%***	0.004	0.014***	0.020***
	(0.0002)	(0.004)	(0.004)	(0.003)
2–3 years	3%***	0.008**	0.013**	0.020***
	(0.0002)	(0.002)	(0.002)	(0.003)
3–4 years	2%***	0.008*	0.012*	0.015***
	(0.0002)	(0.003)	(0.003)	(0.004)
4–5 years	2%***	0.017***	0.010***	0.024***
	(0.0002)	(0.004)	(0.004)	(0.004)

Table 7: Layoffs and wage pass-through across tenure. Columns 3 and 4 report asymmetric pass-through to positive and negative shocks. Data: DADS Panel + FARE, 2009–2019.

B.2 Robustness

B.2.1 Minimum wage threshold

In my baseline evaluation I remove observations with wages less than 5% above the national minimum wage. To check for sensitivity to this choice, I consider two more cutoff values: right at the minimum wage and 20% above.

I first redo the wage passthrough regression across firms. For each sampling version, I reconstruct the firm brackets. I find little impact of the change in the minimum wage cutoff on either layoff rate of the wage passthrough of firms. The largest difference is that of the wage passthrough at the firms firing the most. After raising the cutoff, I find that the wage passthrough is even more negative than in the original case, supporting the paper's conjecture that the low/negative wage passthrough is not an outcome of exogenous sources of wage rigidity like minimum wage.

	At min wage		Baseline: 5% above		20% above	
	Layoffs	Wages	Layoffs	Wages	Layoffs	Wages
Low layoff rate	0.05%	0.017^{***}	0.05%	0.017^{***}	0.09%	0.020^{***}
		(0.0006)		(0.0006)		(0.0007)
Medium layoff rate	1.5%	0.012^{**}	1.5%	0.012^{**}	1.5%	0.012^{***}
		(0.0008)		(0.0008)		(0.0009)
High layoff rate	9.7%	-0.002^{***}	9.7%	-0.002^{***}	9.1%	-0.010^{***}
		(0.0006)		(0.0006)		(0.0007)

Table 8: Wage pass-through across firms: different minimum wage cutoffs. Data: DADS Panel + FARE, 2009–2019.

Next, I perform the same robustness check for the heterogeneity across worker tenure. The differences are minimal both in the layoff rates and in the wage passthrough. I take this as implying that the choice of the minimum wage cutoff is not qualitavely nor quantitatively important for my analysis.

B.2.2 Additional Controls

I introduce additional controls for my layoff and wage passthrough regressions to ensure robustness with respect to alternative explanatory variables. The four key controls I introduce are: worker experience as an alternative to worker tenure, firm fixed effect, occupation fixed effect, and region fixed effect.

	At min wage		Baseline: 5% above		20% above	
	Layoffs	Wages	Layoffs	Wages	Layoffs	Wages
<1 year	5.4%	0.012	11%***	0.000	12%	−0.01***
			(0.0002)	(0.004)	(0.0002)	(0.0009)
1–2 years	0.6%	0.017	5%***	0.004	5%	0.003*
			(0.0002)	(0.004)	(0.0003)	(0.0012)
2–3 years	0.42%	0.023	3%***	0.008**	4%	0.007***
			(0.0004)	(0.002)	(0.0004)	(0.0013)
3–4 years	0.15%	0.025	2%***	0.008*	3%	0.006***
			(0.0003)	(0.003)	(0.0004)	(0.0015)
4–5 years	0.06%	0.025	2%***	0.019***	2%	0.016***
			(0.0004)	(0.004)	(0.0004)	(0.0016)

Table 9: Layoffs and wage pass-through across tenure for different values of minimum wage.

For the across-firm comparison, I focus on wage passthrough as the firm brackets are defined by their layoff rates. For wage passthrough, I find that introducing firm fixed effects has the largest impact on the estimates. While the wage passthrough at the firms laying off the least is not affected, the firms in the middle end up with an ever lower wage passthrough than before, and firms firing the most end up with an even more negative wage passthrough, although now insignificant. Overall, I take these results to conclude that the connection between layoff rate and wage passthrough across firms is robust to additional controls. I perform the same exercise for the worker tenure, looking at the heterogeneity in both layoff rates and wage passthrough. Once I introduce fixed effects, the "baseline" layoff rate of juniors is no longer identified so I set their layoff rate to the value with experience controls and focus on the layoff risk drops with higher tenure levels.

I find some dispersion in layoff rates across specifications, particularly from introducing the firm fixed effects, but ultimately the pattern of an initially sharply then slowly dropping layoff rate persists. Similarly, I introduce controls into the wage passthrough regression across worker tenure. The most noticeable change is the drop in the wage passthrough for the more senior workers. Still, the consistent rise in wage passthrough is still prevalent in each and every specification suggesting that the choice of controls has no significant impact on the empirical results and for the validation of my model's empirical predictions.

	(1)	(2)	(3)	(4)	(5)
Low layoff rate	0.017^{***}	0.019^{***}	0.018^{***}	0.018^{***}	0.018^{***}
	(0.0006)	(0.0007)	(0.0022)	(0.0022)	(0.0022)
Medium layoff rate	0.012^{***}	0.012^{***}	0.007	0.007	0.007
	(0.0008)	(0.0009)	(0.0057)	(0.0058)	(0.0058)
High layoff rate	-0.002^{***}	-0.008^{***}	-0.005	-0.005	-0.005
	(0.0006)	(0.0007)	(0.0068)	(0.0068)	(0.0068)
Experience controls		Yes	Yes	Yes	Yes
Firm FE			Yes	Yes	Yes
Occupation FE				Yes	Yes
Region FE					Yes

Table 10: Wage pass-through across firms with different controls.

	(1)	(2)	(3)	(4)	(5)
<1 year	$11\%^{***}$	$13\%^{***}$	$13\%^{***}$	$13\%^{***}$	$13\%^{***}$
	(0.0002)	(0.0004)	(0.0002)	(0.0002)	(0.0002)
1-2 years	$5\%^{***}$	$6\%^{***}$	$8\%^{***}$	$8\%^{***}$	$8\%^{***}$
	(0.0002)	(0.0004)	(0.0011)	(0.0011)	(0.0011)
2-3 years	$3\%^{***}$	$5\%^{***}$	$7\%^{***}$	$7\%^{***}$	$7\%^{***}$
	(0.0004)	(0.0004)	(0.0014)	(0.0014)	(0.0014)
3-4 years	$2\%^{***}$	$4\%^{***}$	$7\%^{***}$	$7\%^{***}$	$7\%^{***}$
	(0.0003)	(0.0004)	(0.0015)	(0.0015)	(0.0015)
4-5 years	$2\%^{***}$	$3\%^{***}$	$6\%^{***}$	$6\%^{***}$	$6\%^{***}$
	(0.0004)	(0.0004)	(0.0025)	(0.0025)	(0.0025)
Experience controls		Yes	Yes	Yes	Yes
Firm FE			Yes	Yes	Yes
Occupation FE				Yes	Yes
Region FE					Yes

Table 11: Layoffs across worker tenure with different controls.

	(1)	(2)	(3)	(4)	(5)
<1 year	-0.008^{***}	-0.008^{***}	-0.005	-0.004	-0.004
	(0.004)	(0.001)	(0.005)	(0.005)	(0.005)
1-2 years	0.004	0.004^{***}	0.003	0.003	0.003
	(0.004)	(0.001)	(0.004)	(0.004)	(0.004)
2-3 years	0.008^{**}	0.008^{***}	0.006^{*}	0.006^{*}	0.006^{*}
	(0.002)	(0.001)	(0.003)	(0.003)	(0.003)
3-4 years	0.008^{*}	0.008^{***}	0.007^{*}	0.007^{*}	0.007^{*}
	(0.002)	(0.001)	(0.004)	(0.004)	(0.004)
4-5 years	0.019^{***}	0.015^{***}	0.010^{***}	0.010^{**}	0.010^{**}
	(0.004)	(0.002)	(0.004)	(0.004)	(0.004)
Experience controls		Yes	Yes	Yes	Yes
Firm FE			Yes	Yes	Yes
Occupation FE				Yes	Yes
Region FE					Yes

Table 12: Wage passthrough across worker tenure with different controls.