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Abstract

Employment protection harms early-career employees without benefitting them in later career stages (Leonardi and Pica, 2013). We demonstrate that this pattern can result from employers exploiting naïve present-biased employees. Employers offer a dynamic contract with low early-career wages, an unattractive intermediate qualification stage, and high end-of-career wages. Upon reaching the qualification stage, present-biased employees exchange future wages for immediate rewards on an alternative career path – a choice unanticipated by their previous, naïve, self. Thus, employers never pay high future wages. Firing costs help employers indicate that they will not oust employees instead of making promised payments, enabling early-career wage cuts.

Keywords: Employment protection laws, present bias, dynamic contracting

JEL Codes: D21, D90, J33, K31, M52

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1 Introduction

Employment protection laws (EPLs) are widespread across the globe. A common feature of these laws is that they impose firing costs on employers. Hereby, policymakers hope to secure employees' job stability (Betcherman, 2013), prevent their unfair treatment (OECD, 2013), or foster the development of firm-specific human capital through sustained employment relationships (Pierre and Scarpetta, 2004; Belot et al., 2007; Acharya et al., 2013). Although EPLs appear effective in reaching these objectives (Betcherman, 2013), their overall benefit to employees remains unclear.[1] A particularly underexplored aspect is whether firing costs allow employers to reorganize their labor contracts in ways that adversely affect employees' career trajectories and wages.

This paper demonstrates that firing costs can, indeed, impose such detrimental consequences on employees: they allow employers to exploit early-career employees by lowering their contractual wages if they are not fully rational. Consequently, well-meaning policies like EPLs may unintendedly benefit employers at the expense of the employees they aim to protect. The pathway to derive this conclusion involves deviating from conventional models that typically assume rational, time-consistent individuals. As broadly documented in the literature (DellaVigna, 2009; Cheung et al., 2021), many people are present biased (i.e., they put extra weight on present versus future consumption), and they are naïve about it (i.e., they expect not to be present biased in the future). Our simple principal-agent model shows that if one incorporates this fact, the adverse effect of EPLs for employees emerges.

Specifically, in our model, higher firing costs allow the employer (principal, she) to reduce early-career wages for a (partially) naïve present-biased worker (agent; he), without changing wages in later career stages. This compensation scheme follows from the structure of a profit-maximizing exploitation contract that the principal designs to exploit the agent. The key and novel feature of this contract is that the principal endogenously creates a dynamic compensation structure with low payments at the beginning and a promise of high payments at late career stages. Before enjoying higher wages in later periods, the agent must participate in an unattractive "qualification period." Due to his tendency to prefer immediate rewards, however, he eventually opts for lower immediate payments and – unanticipated by his previous, naïve, self – foregoes the qualification period and also the subsequent higher wages he could earn. In this context, higher firing costs allow the principal to cut early-career wages further, as she can now promise more convincingly that she will not lay off the agent in later career stages.

[1] There is some past research highlighting potential indirect negative effects of these policies for employees. Higher firing costs, for example, distort employers' incentives to create new jobs. As a result, employment protection laws may erode overall employment or affect the dynamics of labor markets (Bertola and Rogerson, 1997; Hopenhayn and Rogerson, 1993; Mortensen and Pissarides, 1994).

Thus, higher firing costs increase her profits by apparently making it more difficult to back out from her promises.

Our paper, thus, augments the vast existing literature on how firms can exploit present-biased consumers (see Kőszegi, 2014, or Heidhues and Koszegi, 2018, for overviews of the literature). While previous studies have discussed the role laws and market characteristics play in mitigating or enforcing this exploitation (Handel, 2013; Ericson, 2014; Sulka, 2023), there is a notable lack of understanding about the influence of labor market institutions on firms' ability to exploit present-biased employees. This oversight represents a critical gap in the literature, especially considering (a) the growing evidence that present bias matters in the workplace (Kaur et al., 2015, Mas and Pallais, 2017) and (b) employers more and more leverage peope analytics methods and big data to learn about their employees' characteristics and biases. Given their relevance, it is, therefore, crucial to dissect (a) how employers may capitalize their employees' psychological tendencies and (b) how policies affect this behavior.

Moving to the more detailed exposition of our model, we base our analysis on the following principal-agent model setup. A risk-neutral principal and a risk-neutral agent interact over three periods. The principal discounts future profits exponentially; the agent is present biased and discounts his future utility in a quasi-hyperbolic way (Laibson, 1997). At the beginning of the first period, the principal offers a long-term contract to the agent. While the long-term contract determines both parties' obligations in case employment continues, either the principal or the agent can terminate the relationship at the beginning of the second and third periods. A termination by the principal requires her to pay a fixed firing cost K, determined by the severity of employment protection laws.[2] By contrast, the agent is always free to leave at no cost. The principal's employment offer contains a wage in exchange for costly effort exerted by the agent, with effort being verifiable.

Our first contribution is to determine the optimal contracts for an agent with and without a present bias. If the agent is not present biased, or if he is present biased but sophisticated (i.e., fully aware of his bias), short-term incentives are optimal, i.e., payments for effort are made in the same period as it is exerted. Intuitively, because effort is verifiable, such short-term incentives secure the first-best effort and leave the agent with his outside option.

By contrast, when employing a naïve agent who is not aware of his future present bias, the principal designs a long-term contract that specifies (a) a wage payment (and first-best effort) in period 1 and (b) a menu of career paths among which the agent can choose in period 2. This menu consists of a "virtual" path the agent initially intends to choose and a "real" path he

[2] A common interpretation of firing costs is understanding them as a "tax on job destruction." This tax typically reflects real costs on separations and, because it is paid outside the firm-worker pair, the firm cannot include it into the wage bargaining process (Bertola and Rogerson, 1997).

inadvertently ends up selecting. While the real path contains wage payments that cover the agent's respective effort costs, the principal designs the virtual path so that period 2 serves as a "qualification period," in which the agent's utility is low. In period 3, the virtual path promises the agent a high utility level.

We next discuss why offering this menu is optimal. From the perspective of period 1, which involves an extra weight on period-1 utility but the same weights on utilities in periods 2 and 3,[3] the agent would optimally select the virtual career path in the subsequent period. However, when period 2 comes, the agent puts a higher weight on period-2 than on period-3 utility; therefore, the relative costs of the qualification period 2 loom larger than they did from the perspective of period 1. He is consequently willing to sacrifice the high period-3 rent in exchange for a moderately higher current period-2 payment – which the real path provides. Because the naïve present-biased agent does not anticipate his eventual choice of the real career path, the rent promised in the virtual path makes him willing to accept a lower compensation in the first period and leaves him with a utility below his outside option. All this implies that offering a steep career path with low utility in early periods but high utility at later career stages is optimal for the principal. The principal, therefore, transforms an inherently static contracting setting – effort can be verified and compensated in the same period as it is exerted – into a dynamic contract.[4] Because the agent is naively present biased, he cannot overcome the barriers established by the principal in the form of the qualification period. Consequently, he picks the flat compensation scheme provided by the real career path in period 2 even though he had agreed to a low first period wage in anticipation of the high future rent provided by the virtual path.

Building on this baseline model, our second contribution lies in demonstrating that higher firing cost K allow the principal to exploit early-career employees by lowering their contractual wages more extensively. Specifically, firing costs affect the structure of the real and virtual career paths. Importantly, the extent to which the principal can exploit the agent during the beginning of his career (i.e., decrease the period-1 wage) increases in the perceived attractiveness of the third period in the virtual path. There, the principal's credibility to make promises is limited by her general ability to fire the agent. Therefore, higher firing costs bolster the firm's credibility in committing to promises made in the virtual path (as layoffs are now costlier), thereby increasing its attractiveness to the agent. This shift in the contract's attractiveness allows the principal to increase her profits at the expense of the agent. Moreover, while higher

[3] Note that, for simplicity, we abstract from standard, exponential discounting.

[4] Note that, even if real-world employment relationships do not have detailed contracts that explicitly describe future compensation, there often is an implicit understanding that, if an employee exerts a lot of effort or takes up certain career development options, he will be promoted or rewarded in another way.

firing costs reduce the introductory wage paid in period 1, realized wages in periods 2 and 3 remain unaffected. Along these lines, firing costs may not only help (for reasons outside of our model) but also harm employees (by lowering their wages). Consequently, this effect should be particularly pronounced for young employees in new job matches and limited for older and incumbent ones.[5]

The following observations further underscore the importance of our analysis. First, our predictions are in line with results presented in the empirical literature which previous theories could not explain. For example, a number of papers find that firing costs, indeed, depress wages (as predicted by the model). Cervini-Pla et al., 2014 demonstrate that a reduction in firing costs in Spain led to higher wages for affected workers. Similarly, Leonardi and Pica (2013) study a reform that increased firing costs in Italy and show that it slightly reduced wages. Consistent with our prediction, they find that this effect is mostly driven by young workers in new matches, where wages remained steady for older and incumbent workers.[6] Moreover, our model can also provide an explanation for evidence documenting that the consequences of higher firing costs on job creation are not as negative as the previous theoretical literature has predicted.[7] These predictions have been based on the higher cost of employment in response to a reduced flexibility of adjusting one's workforce. Our model, on the contrary, derives a mechanism where higher firing cost increase profits, which would consequently boost a firms' propensity to create jobs. Lastly, in line with one of our extensions that accounts for differences in bargaining power, Leonardi and Pica (2013) find that the negative effect of firing costs on wages is particularly strong for workers with low bargaining power. We show that a higher bargaining power of the agent reduces the principal's ability to take advantage of the agent's present bias. Put differently, the negative effect of a higher firing cost on the agent's compensation gradually diminishes with the agent's bargaining power.

The second observation is that, although our primary analysis zeroes in on firing costs, our model provides additional insights on the consequences of labor market institutions. For ex-

[5]If a naïve agent was hired in period 2, no dynamic exploitation contract would be feasible because it requires at least 3 periods. In such a case, static contracts would be offered for both periods, with firing cost being irrelevant.

[6]To explain their results, Leonardi and Pica (2013) focus on models of labor market frictions and decentralized bargaining. In such a model, higher firing costs increase incumbent workers' bargaining position and, thus, allow them to raise their wages. New workers, on the other hand, "pre-pay" for the increased job security and accept lower wages. In contrast to our theory, their model, however, cannot explain why the reform only reduced wages for "job switchers" and did not increase those for "incumbents." Leonardi and Pica (2013) aim at explaining this discrepancy with the absence of a credible threat by workers in case firms refuse to renegotiate wages. However, if workers anticipated their inability to renegotiate higher wages later on, they should not be willing to accept upfront wage cuts.

[7]While some studies document moderately negative consequences for employment (e.g., Kugler, 2004; Saavedra and Torero, 2004), others indeed find no significant effect (de Barros and Corseuil, 2004; Downes et al., 2004). Generally, the findings are sensitive to model specification and the treatment of the data (Glyn and Schmitt, 2004; Howell et al., 2007).

ample, we show that setting a floor on wages, such as a minimum wage, does not benefit naive present-biased workers and could even reduce efficiency. The reason is that if there is a (binding) minimum wage in place, the employer reacts to her inability to reduce early-period wages by requiring the employee to work overly hard. Consequently, the employee's utility gain from a higher wage is offset by the utility loss due to higher effort, and overall utility remains unchanged. Intriguingly, the naive present-biased worker then ends up working harder than a sophisticated or time-consistent worker.

Our paper relates to three broad fields of literature. First, we contribute to the literature highlighting potential drawbacks of employment-protection policies. Stringent hiring and firing laws can, for example, limit firms' ability to adapt quickly to changes in demand and technology (Kuzmina, 2023) or change the mix of skills workers invest in (Estevez-Abe et al., 2001; Wasmer, 1999). The policies may also undermine labor mobility from declining sectors to new dynamic sectors and, thus, affect (a) the efficient allocation of labor, (b) productivity, or (c) even economic growth (Hopenhayn and Rogerson, 1993; Belot et al., 2007). We add to this literature by demonstrating that employment-protection policies, when interacting with behavioral factors like present bias, can lead to further unintended consequences that traditional analyses overlook. Specifically, our findings reveal a nuanced dynamic where these policies, despite their protective intent, can support exploiting behavioral tendencies and result in suboptimal outcomes for workers. This underscores the necessity for a more holistic approach in policy formulation that considers psychological insights to ensure the well-being of employees in the labor market.

Second, we contribute to the literature discussing implications of the present bias for the design of policies. The earlier papers mainly frame this bias as a form of mis-optimizations that leads to "behavioral mistakes" (such as exercising to little, smoking too much, or under-saving for retirement). Building on this idea, most of the policy-related papers highlight how governments can correct such mistakes with policies such as creating optimal defaults in health insurance (Handel, 2013; Ericson, 2014, 2020), sending reminders (Ericson, 2017), bringing together the time of a decision and its effect (Murooka and Schwarz, 2018, 2019; Johnen, 2019), or setting up mandatory pensions (Sulka, 2023). Rather recently, a number of empirical studies have emerged, indicating that present bias also affects labor-supply decisions (Kaur et al., 2015; Mas and Pallais, 2017). The underlying idea is that employment relationships frequently reward up-front effort with future benefits. Present-biased employees may then inflate their perception of the immediate effort costs and, consequently, exert less effort than their "long-run self" would prefer. Along these lines, the present bias not only influences the design of health and savings policies but also that of labor-market policies. Lockwood (2020), for example, demonstrates that present bias reduces the optimal income tax rate, especially if the elasticity of the taxable income is high. In our view, however, an in-depth analysis of the employment protection policies in the presence of present bias I still missing. We close this gap by analyzing the problem through the lens of a simple principal-agent model.

Third, our paper relates to the literature on optimal exploitation contracts when workers are present biased. This literature is based on the behavioral IO literature which has demonstrated that firms can extract rents from consumers who are unaware of future biases and induced to pay high fees when changing their original plans (DellaVigna and Malmendier, 2004; Eliaz and Spiegler, 2006; Heidhues and Kőszegi, 2010). Gottlieb and Zhang (2021) show that the inefficiency losses of such contracts diminish as the time horizon grows. In an employment setting, Gilpatric (2008), Li et al. (2012), and Yılmaz (2013) study the implications of an employee's present bias if there is moral hazard.

We analyze how a naive employee's naiveté affects contract dynamics, a dimension not explored by these contributions.

The closest paper is Englmaier et al. (2023). In contrast to that paper, our model allows the principal to terminate the relationship, however at some cost, and she can condition payments on effort rather than on outcomes. Moreover, the current paper focuses on how present bias affects labor market policies.

Finally, Fahn and Seibel (2022) also explore the role of commitment in employment relationship. They show that, if a firm is not able to commit to long-term contracts, naïve agents overestimate the extent of future wage reductions due to non-monetary benefits of employment, leading them to accept less reductions in the present. This finding suggests that present-biased employees can benefit from being naïve, too. While Fahn and Seibel (2022) focus on a setting where today's effort increases tomorrow's benefits, our paper shows that even with a static production technology, a dynamic compensation system can emerge as it allows firms to increase profits and to this end exploit naïve employees.

2 Model Setup

Technology A risk-neutral principal ("she") can hire a risk-neutral agent ("he") for three periods, $t \in \{1, 2, 3\}$. If employed in period t, the agent receives a wage $w_t \in \mathbb{R}$ and chooses his effort $e_t \geq 0$. The costs of effort $c(e_t)$ are strictly increasing, differentiable, and convex (with $c(0) = c'(0) = 0$). Denoting the marginal value of the agent's effort by $\theta > 0$, we assume that the effort level e_t generates a deterministic output $e_t\theta$ that is consumed by the principal.

Given these assumptions, the agent's payoff in period t when employed by the principal is

$$w_t - c(e_t).$$

The principal obtains

$$e_t \theta - w_t.$$

If the agent does not work for the principal in period t, he receives his outside option $\overline{u} \in \mathbb{R}^+$; the principal's outside option is normalized to zero.

The effort level maximizing total surplus if the agent works for the principal, the first-best effort denoted by e^{FB}, is defined by

$$\theta - c'(e^{FB}) = 0.$$

Time preferences While the principal discounts the future exponentially with a constant factor $\delta \in (0, 1]$, the agent applies quasi-hyperbolic discounting to future payoffs (Phelps and Pollak, 1968; Laibson, 1997): From the perspective of period $t = 1$, the agent discounts future payoffs with $\beta\,\delta$ (period $t = 2$) or $\beta\,\delta^2$ (period $t = 3$), with $\beta \in (0, 1]$; the discounting between payoffs in periods 2 and 3 is exponential, at rate δ. From the perspective of period $t = 2$, the agent discounts period-3 payoffs with $\beta\,\delta$. Hence, the agent is present biased, and his preferences are dynamically inconsistent. Following the concept of partial naiveté (O'Donoghue and Rabin, 2001), the agent misconceives his future time preferences. He discounts the future using the factor β but expects to use the discount factor $\hat{\beta}$ (with $\beta \leq \hat{\beta} < 1$). In other words, the agent may be aware of his present bias, yet expects it to be weaker than it actually is. In the following, we will mainly focus on two extreme cases. The first case describes a fully naive agent who – in every period – believes his present bias will vanish in the next period, i.e., $\hat{\beta} = 1$. The second case describes a sophisticated agent who is fully aware of his (future) present bias, i.e., $\hat{\beta} = \beta$. For the following analysis, we focus on the consequences of the agent's present bias and, thus, set

$$\delta = 1.$$

We impose this assumption solely for simplicity; it does not affect our qualitative results.

Perceptions We assume common knowledge about the principal's time preferences. On the contrary, the agent's time preferences are not common knowledge. While the principal knows the agent's time preferences and his values β and $\hat{\beta}$, the agent believes the principal shares his own (incorrect) self-perception. A (partially) naive agent is, hence, convinced that the principal also perceives his future present bias as being characterized by $\hat{\beta}$. This assumption borrows from the behavioral IO literature, which posits that firms, through their experience, understand the agents' systematically changing preferences better than the agents themselves (Eliaz and Spiegler, 2006).

Contracts and commitment The principal can commit to long-term contracts but has the option of firing the agent at the beginning of periods 2 and 3 at firing cost $K > 0$. The firing decision is irreversible; subsequently, the principal and agent consume their outside utilities in the subsequent periods. The value of K captures the extent of employment protection in the economy, with higher values indicating more stringent employment protection. Note that the assumption that K is identical in both periods does not affect our results. The reason is that firing costs will matter only in period 3. Furthermore, for now, we abstract from severance payments (i.e., payments that the agent receives after termination) but discuss them in Section 7.

For the remainder of this paper, we assume

$$e^{FB}\theta - c(e^{FB}) - \bar{u} > -K,$$

indicating that firing the agent is inefficient if he exerts e^{FB}.

The agent cannot commit to long-term contracts and is free to leave at the beginning of every period. Moreover, his effort is verifiable; thus, forcing contracts that specify the required effort level the agent has to exert are possible. Our results would remain unchanged if the agent, instead, did not receive the wage w_t when deviating from the contractually specified effort.

Now, in $t = 1$, the principal makes a take-it-or-leave-it contract offer to the agent. This offer contains wage and effort for period 1 and a *menu of career paths*, denoted by C. The agent can select one element from C, labeled $i \in \{1, 2, ..., I\}$, at the beginning of period 2. Each element in C specifies wages and efforts for the next two periods, thus $C = \left\{\left(w_2^i, e_2^i, w_3^i, e_3^i\right)_{i=1}^{I}\right\}$. Without loss of generality, we can restrict I to 1 or 2, depending on the agent's extent of naiveté. If the agent is sophisticated or time-consistent, he correctly anticipates his future behavior, in which case the principal sets $I = 1$. By contrast, if the agent is (partially) naive, the principal optimally sets $I = 2$ such that the menu consists of two paths: one that the agent believes to choose in period 2 (*virtual path*) and one that he actually selects (*real path*). We refer to the virtual path with a superscript "v" and to the real path with the superscript "r." Thus, with a slight abuse of notation, the menu becomes $C = \left\{\left(w_2^r, e_2^r, w_3^r, e_3^r\right), \left(w_2^v, e_2^v, w_3^v, e_3^v\right)\right\}$.

Payoffs Next, we describe the real and perceived payoff streams along the equilibrium path where the agent is (and anticipates to be) employed in every period t. His realized utility streams equal

$$\begin{aligned}
U_1^r &= w_1^r - c(e_1^r) + \beta\left(w_2^r - c(e_2^r) + w_3^r - c(e_3^r)\right)\\
U_2^r &= w_2^r - c(e_2^r) + \beta\left(w_3^r - c(e_3^r)\right)\\
U_3^r &= w_3^r - c(e_3^r).
\end{aligned}$$

These U_t^rs correspond to the utilities a sophisticated or time-consistent agent receives (in the latter case with $\beta = 1$).

(Partially) naive agents expect to select the virtual path in period 2; thus, their perceived utility streams *from the perspective of period* 1 are

$$\begin{aligned}
U_1^v &= w_1^r - c(e_1^r) + \beta\left(w_2^v - c(e_2^v) + w_3^v - c(e_3^v)\right)\\
U_2^v &= w_2^v - c(e_2^v) + \hat{\beta}\left(w_3^v - c(e_3^v)\right)\\
U_3^v &= w_3^v - c(e_3^v).
\end{aligned}$$

The principal's payoffs are

$$\begin{aligned}
\Pi_1^r &= e_1^r\theta - w_1^r + e_2^r\theta - w_2^r + e_3^r\theta - w_3^r\\
\Pi_2^r &= e_2^r\theta - w_2^r + e_3^r\theta - w_3^r\\
\Pi_3^r &= e_3^r\theta - w_3^r,
\end{aligned}$$

while the naive agent perceives them to be

$$\begin{aligned}
\Pi_1^v &= e_1^r\theta - w_1^r + e_2^v\theta - w_2^v + e_3^v\theta - w_3^v\\
\Pi_2^v &= e_2^v\theta - w_2^v + e_3^v\theta - w_3^v\\
\Pi_3^v &= e_3^v\theta - w_3^v.
\end{aligned}$$

Strategies and equilibrium Following O'Donoghue and Rabin (1999), we describe the players' strategies using the term *perception-perfect strategy*. Such a strategy specifies a player's actions based on dynamically consistent beliefs about their future behavior. While a time-consistent or sophisticated agent correctly anticipates his future actions, a (partially) naive agent may hold wrong beliefs about his future time preferences.

We denote a principal's strategy by σ_P. In period $t = 1$, this strategy determines the long-term contract C. In periods $t = 2, 3$, σ_P specifies whether the principal adheres to the contract or fires the agent at a cost K. Similarly, we refer to the agent's strategy with σ_A. His strategy determines in each period whether the agent works for the principal (and exerts the contracted effort level e_t) or opts for his outside option. In period 2, σ_A also specifies his choice from C.

We apply the concept of *perception-perfect equilibrium*. This equilibrium maximizes each player's payoff, given their perception of their own and the other player's future behavior. Because the principal can make a take-it-or-leave offer at the start of period 1, she offers the menu C that maximizes Π_1^r. In all later periods, her decision revolves around firing the agent or not, doing so only if it is optimal. The (partially) naive agent maximizes U_1^v in every period and expects the principal to maximize Π_t^v rather than Π_t^r.

3 Optimal Contract: Time-consistent and Sophisticated Agents

We first derive two benchmarks: profit-maximizing contracts for (a) non-present-biased agents and (b) sophisticated agents.

Time-consistent agent Consider an agent without a present bias ($\beta = \hat{\beta} = 1$). Because the agent's effort is verifiable, the contract

$$e_t = e^{FB}, w_t = c(e^{FB}) + \overline{u}$$

in each period t maximizes both the surplus and the principal's profits. The agent always accepts this contract. Moreover, the principal extracts the entire surplus, eliminating any incentive to fire the agent.

Sophisticated present-biased agent A sophisticated present-biased agent ($\hat{\beta} = \beta$) correctly anticipates his future choices. Thus, the principal lets C consist of only one element, and the same contract as for a time-consistent agent maximizes surplus and profits (i.e., $e_t = e^{FB}$, $w_t = c(e^{FB}) + \overline{u}$ in every t). The payoffs under such a contract are

$$\begin{aligned} \Pi_1 =& 3\left(e^{FB}\theta - c(e^{FB}) - \overline{u}\right) \\ U_1 =& \bar{u}\left(1 + 2\beta\right). \end{aligned}$$

This contract ensures the agent accepts the contract in every period, induces him to exert the surplus-maximizing effort level, and allows the principal to extract the entire surplus. Note that adjusting this contract to account for the agent's effectively lower discount factor by front-loading payments to period 1 (in exchange for lower payments in later periods) is not beneficial for the principal. In such a case, the agent – who cannot commit – would quit working for the principal after the first period.

Thus, if the agent is sophisticated, his present bias does not affect the profit-maximizing contract. This result follows from (a) the verifiability of effort and (b) the static production technology that allows effort and compensation to be realized in the same period. However, with a naive agent, the principal finds it optimal to create a dynamic compensation structure endogenously.

4 Optimal Contract: Naive Agents

This section analyzes the principal's optimization problem when facing a naive present-biased agent (i.e., an agent with $\hat{\beta} = 1$). Section 6.3 demonstrates that the results are the same for any $\hat{\beta} \in (\beta, 1)$.

4.1 Optimization Problem

The principal can always offer a naive agent the same contract as a sophisticated agent. Consequently, $3\left(e^{FB}\theta - c(e^{FB}) - \overline{u}\right)$ sets a lower bound for the principal's profits, who therefore never finds it optimal to fire the agent. In the following, we demonstrate that the principal can further increase her profits. To that end, she can design a dynamic incentive scheme containing a menu of career paths to exploit the naive agent's misperception of his future behavior. Menu C includes both the virtual path (that seems optimal to the agent from the perspective of period 1) and the real path (the agent ultimately selects). Next, we derive a series of constraints this menu C must fulfill.

Individual rationality constraints for the agent The first condition ensures that the agent finds it optimal to accept C in period 1. He does so under the expectation of choosing the virtual path in period 2 instead of rejecting C and consuming $\overline{u}$ in all periods. Formally, we have

$$\text{(IRA1)} \qquad w_1^r - c(e_1^r) + \beta\left(w_2^v - c(e_2^v) + w_3^v - c(e_3^v)\right) \geq \bar{u} + 2\beta\bar{u}.$$

Furthermore, in periods 2 and 3, the agent's real and perceived utilities must exceed his outside option:

$$U_2^r \geq \bar{u} + \beta\bar{u} \tag{rIRA2}$$

$$U_3^r \geq \bar{u} \tag{rIRA3}$$

$$U_2^v \geq 2\bar{u}, \tag{vIRA2}$$

$$U_3^v \geq \bar{u}. \tag{vIRA3}$$

Note that a constraint $U_1^r \geq \bar{u} + 2\beta\bar{u}$ is *not* necessary because the agent does not expect to choose the real path. In fact, under the profit-maximizing contract, this condition turns out to be violated.

Individual rationality constraints for the principal As previously mentioned, because the principal's profits are always larger than with a sophisticated agent, she will never fire the agent. However, the agent's first-period self must believe the principal will not fire him in the periods $t = 2, 3$ if he has chosen the virtual path:

$$\Pi_2^v \geq -K, \tag{vIRP2}$$

$$\Pi_3^v \geq -K. \tag{vIRP3}$$

If either of these constraints is not satisfied, the agent expects to be laid off in a future period. This feature contrasts with studies such as Eliaz and Spiegler (2006, 2008) or Heidhues and Kőszegi (2010), where firms have unlimited commitment power. We deviate from this approach to account for the institutional environment of labor markets that likely restrict commitments.

Selection constraints As a final condition, the agent must expect to choose the virtual path in the second period but actually select the real path.

$$\begin{aligned} & w_2^r - c(e_2^r) + \beta\left(w_3^r - c(e_3^r)\right) \\ \geq & w_2^v - c(e_2^v) + \beta\left(w_3^v - c(e_3^v)\right), \end{aligned} \tag{rC}$$

$$\begin{aligned} & w_2^v - c(e_2^v) + w_3^v - c(e_3^v) \\ \geq & w_2^r - c(e_2^r) + w_3^r - c(e_3^r). \end{aligned} \tag{vC}$$

Objective The principal's objective is to offer a long-term contract C that maximizes her first-period profits Π_1^r, subject to the constraints just derived.

4.2 Profit-Maximizing Contract

A profit-maximizing contract has two main components. First, the principal shifts the largest possible share of the agent's compensation to period 3 of the virtual career path. Second, the principal designs the virtual path for period 2 to be less attractive than expected by the naive agent (who does not anticipate the discounting between periods 2 and 3).

Thought experiment To demonstrate why such a contract structure allows the principal to exploit the agent, let us introduce a thought experiment. Imagine the principal offers the naive, present-biased agent the optimal contract for the sophisticated agent. This contract provides the outside option in every period. Starting from this contract, suppose we reduce the agent's period-1 payoff by $\Delta_1 > 0$ and increase his period-3 payoff by Δ_1/β. Moreover, we lower his period-2 payoff by Δ_2 and shift this amount to the third period. From the first period's view, decreasing w_1 by Δ_1 and w_2 by Δ_2, and increasing w_3 by $\Delta_1/\beta + \Delta_2$ keeps the agent indifferent to the original situation. That is because

$$\underbrace{-\Delta_1}_{t=1} + \underbrace{\beta\left(\underbrace{-\Delta_2}_{t=2} + \underbrace{\Delta_1/\beta + \Delta_2}_{t=3}\right)}_{=\Delta_1} = 0.$$

However, from the perspective of period 2, the agent's payoff from this operation is $-\Delta_2 + \beta(\Delta_1/\beta + \Delta_2) = \Delta_1 - (1-\beta)\Delta_2 < \Delta_1$. Thus, if the principal instead offers an increased payment of $\Delta_1 - (1-\beta)\Delta_2$ paid *in period 2*, the agent will accept it. This transaction boosts the principal's total profits by $(1-\beta)\Delta_2$ compared to the optimal contract for a sophisticated agent.

This discussion demonstrates that the principal should create a menu of career paths that includes (a) a virtual path that the agent expects to select in the second period and (b) a real path that the agent actually chooses. While the principal shifts the payments of the virtual path to the third period, the real path offers higher second-period and lower third-period payments. By designing this menu, the principal exploits the agent's ignorance of discounting the period-3 payoffs from the perspective of period 2.

The following Proposition (1) details how this contract structure determines the components of a profit-maximizing contract. Here, $\tilde{U}_1^r$ represents the agent's long-term utility that does not discount future payments.

Proposition 1. *A profit-maximizing contract has the following features:*

- *All effort levels are e^{FB}.*
- *Wages are*

$$\begin{aligned}
w_1^r &= c(e^{FB}) + \bar{u} - \beta\,(1-\beta)\left(e^{FB}\theta - c(e^{FB}) - \bar{u} + K\right) \\
w_2^r &= w_3^r = c(e^{FB}) + \bar{u} \\
w_2^v &= c(e^{FB}) + \bar{u} - \beta\left(e^{FB}\theta - c(e^{FB}) - \bar{u} + K\right) \\
w_3^v &= K + e^{FB}\theta.
\end{aligned}$$

- *Payoffs are*

$$\begin{aligned}
U_1^r &= (1+2\beta)\,\bar{u} - \beta\,(1-\beta)\left(e^{FB}\theta - c(e^{FB}) - \bar{u} + K\right) \\
\tilde{U}_1^r &= 3\bar{u} - \beta\,(1-\beta)\left(e^{FB}\theta - c(e^{FB}) - \bar{u} + K\right) \\
\Pi_1^r &= 3\left(e^{FB}\theta - c(e^{FB}) - \bar{u}\right) + \beta\,(1-\beta)\left(e^{FB}\theta - c(e^{FB}) - \bar{u} + K\right).
\end{aligned}$$

Proposition 1 demonstrates that the real path involves the same second-period and third-period components as the contract for a time-consistent or sophisticated agent. However, the first-period wage is lower: The wage component w_1 encompasses $c(e^{FB}) + \overline{u}$, which corresponds to the agent's "fair" compensation; the term $\beta\,(1-\beta)\left(e^{FB}\theta - c(e^{FB}) - \bar{u} + K\right)$ is subtracted from the fair compensation and indicates the extent of his exploitation. This term reflects the total expected and discounted rent the agent expects from choosing the virtual path in the future (i.e., from making a career), and it "serves" as the reward for *today's* effort.

Another insight of the proposition is that the principal's goal is to maximize the agent's payment in the third period of the virtual path. The reason is that this decision allows her to reduce w_1 by more. However, the third-period wage must be sufficiently low to ensure that it does not seem optimal (from the agent's perspective) for the principal to fire him to prevent the "promised" payments. Therefore, w_3^v includes the total output and the firing cost, making the principal indifferent between retaining and firing the agent. The principal crafts the virtual path's second period sufficiently unattractive that the agent actually selects the real path.

Two additional aspects are noteworthy. First, under an optimal contract, all effort levels align with the first-best level. This feature maximizes the effective surplus and enables the principal to set the highest w_3^v to maximally exploit the agent. Only in period 2 of the virtual path, the first-best effort is not uniquely optimal. In this case, the difference $w_2^v - c(e_2^v)$ matters, making the “qualification period” unattractive due to either low wages or high effort. We conclude that the role of effort is negligible in our main model. However, the effort level becomes more relevant in Section 6.1, where we introduce a lower bound on payments.

Second, as discussed as part of the thought experiment, the agent’s exploitation depends solely on Δ_2 (i.e., the size of the reduction in the second period). The reason why the optimal contract specified in Proposition 1 then involves a *first-period* wage reduction is that the agent is always free to leave. Thus, under the real path, he must at least also receive his outside option in period 2. The wage reduction in period 1, therefore, grants the agent a future rent, which is later reduced due to his time inconsistency.

Finally, while all these results imply that the principal’s profits are larger than with a sophisticated or time-consistent agent, the agent’s utility is lower.

The possibility of exploiting agents who deviate from their planned action aligns with findings in the literature. Relevant papers, for example, include DellaVigna and Malmendier (2004), Eliaz and Spiegler (2006, 2008), or Heidhues and Kőszegi (2010). However, in our view, the specific structure in a labor-market context is particularly striking. Here, an inherently static problem naturally and endogenously transforms into a dynamic system, a feature not present in these previous studies.

5 The Role of Firing Costs

We have established that principals can exploit naive agents. This section focuses on our key topic: It explores how firing costs K influence these exploitation possibilities and the structure of the optimal contract. Drawing from the earlier discussion and Proposition 1, we introduce Proposition 2.

Proposition 2. *The first-period wage decreases in the firing cost K, second- and third-period real wages are independent of K.*

Building on the previous discussion and Proposition 2, a higher K enables the principal to promise greater future payments while, at the same time, lowering the first-period wage. The logic is straightforward: Rising firing costs enhance the principal’s commitment to the working relationship, thereby elevating the (perceived) relationship surplus, which the agent expects to be paid in the third period. However, the first-period wage the agent accepts decreases in the (perceived) surplus. As a result, higher firing costs lower first-period wages. Moreover, second- and third-period real wages are unaffected by K because the agent then receives his outside option. The fact that the impact concentrates on period 1 suggests that, empirically, young workers and workers in newly formed employment relationships should experience larger wage reductions. If the principal hired an agent in the second period, she would offer two subsequent spot contracts, as with a time-consistent or a sophisticated agent. The reason is that an exploitation contract as derived above requires at least 3 periods.

Link to empirical evidence Our theoretical finding on the role of firing costs aligns with the empirical evidence. For example, Leonardi and Pica (2013) analyze the impacts of a 1990 labor market reform in Italy. The reform raised firing costs for smaller firms (up to 15 employees) but not for larger ones (more than 15 employees). Analyzing administrative data with a regression discontinuity difference-in-difference design, the authors document that increased firing costs slightly lower average wages. In line with our prediction, the reduction is significantly stronger for (a) young workers below 30 and (b) entry wages of job switchers.

Leonardi and Pica (2013), instead, try to rationalize these results with "conventional" models of labor market frictions and decentralized bargaining. In these models, higher firing costs strengthen the incumbent workers' bargaining power, leading to higher wages. By contrast, new workers "pre-pay" for the added job security and accept lower wages. However, Leonardi and Pica (2013) only observe wage reductions for "job switchers," while the "incumbents" wages remain unaffected. This observation contradicts their theoretical framework (the incumbents' wages should increase). Instead, it aligns with our model, where a higher K does not impact existing relationships. Leonardi and Pica (2013) attribute this discrepancy to the lack of a credible threat for workers because firms may refuse to renegotiate wages. Yet, if workers anticipate their later inability to renegotiate for higher wages, they should not accept wage cuts in the first place. Thus, our explanation more aptly accounts for the empirical results of Leonardi and Pica (2013).

6 Extensions

Building on our initial model, this section explores several extensions. We explore the effects of minimum wages, analyze the role of labor market competition and bargaining power, and examine the concept of partial naiveté and its influence on profit-maximizing employment contracts.

6.1 Lower Bounds on Wages

Until now, the principal faced no restrictions on setting the wage, potentially leading to negative wages. We next demonstrate that, similarly to employment protection, the agent also does not necessarily benefit from a lower wage bound (e.g., caused by a minimum wage).

Formally, the wage w must meet or exceed $\bar{w}$,

$$w \geq \bar{w},$$

where $\bar{w}$ represents the lower bound. Moreover, let us assume that

$$\bar{w} \leq c(e^{FB}) + \bar{u}.$$

The equation ensures that the lower bound is not binding for the time-consistent or sophisticated agent. Therefore, $\bar{w}$ only matters if it exceeds w_1 and w_2^v from our main model,

$$\begin{aligned} w_2^v &= \bar{u} + c(e^{FB}) - \beta\left(e^{FB}\theta - c(e^{FB}) - \bar{u} + K\right) \\ &< w_1^r = c(e^{FB}) + \bar{u} - \beta(1-\beta)\left(e^{FB}\theta - c(e^{FB}) - \bar{u} + K\right), \end{aligned}$$

although our model did not uniquely define w_2^v.

Building on these assumptions, Proposition 3 shows that a binding minimum wage does not benefit the worker but instead increases the required first-period effort. This effort adjustment also applies to the second-period virtual path, where a binding minimum wage shifts the emphasis in the "qualification period" towards higher effort instead of lower wages.

Proposition 3. *Assuming wages must exceed a minimum wage $\bar{w} \leq c(e^{FB}) + \bar{u}$, the agent's utility remains unaffected. Moreover, if*

$$\bar{w} > c(e^{FB}) + \bar{u} - \beta(1-\beta)\left(e^{FB}\theta - c(e^{FB}) - \bar{u} + K\right),$$

then $w_1 = \bar{w}$. The effort in period 1 becomes

$$c(e_1) = \bar{w} - \bar{u} + \beta(1-\beta)\left(e^{FB}\theta - c(e^{FB}) - \bar{u} + K\right),$$

which exceeds e^{FB} and increases in $\bar{w}$ and K. If

$$\bar{w} > c(e^{FB}) + \bar{u} - \beta\left(e^{FB}\theta - c(e^{FB}) - \bar{u} + K\right),$$

then $e_2^v > e^{FB}$. Moreover,

$$c(e_2^v) \geq \bar{w} - \bar{u} + \beta\left(e^{FB}\theta - c(e^{FB}) - \bar{u} + K\right).$$

Interestingly, the agent is not better off with non-negativity constraints on payments than without them but attains the same level of real utility. Intuitively, the agent does not benefit from the wage bound because the principal optimally responds to the policy by requesting higher effort, setting e_1^r above e^{FB}. Therefore, the naive present-biased agent may even work *harder* than an agent without such a bias. Moreover, the principal bears the entire burden of this inefficient outcome: Because inefficiently high effort reduces total surplus, she can extract less from the agent than when the payments are unrestricted.

Proposition 3 suggests that a policymaker increasing a minimum wage should monitor (and potentially regulate) the effort (work hours) in occupations with a binding minimum wage, especially for young employees.

6.2 Labor Market Competition and Bargaining

We have previously assumed that the principal has full bargaining power and, thus, can determine the terms of the employment relationship. This section discusses a scenario where the agent also has some bargaining power. We operationalize bargaining as follows: Instead of explicitly modeling the bargaining process, we assume that the players arrive at a Nash bargaining outcome in period 1. Here, the principal retains the share α of the total relationship surplus, and the agent gets the share $1-\alpha$. More specifically, the agent accepts any offer that leaves him with $1-\alpha$ of his "present-biased view" of the total relationship surplus. Importantly, in periods $t = 2, 3$, the relationship surplus includes the principal's firing costs K. Note that the original contract can also specify that, *in later periods*, a party gets more (or less) than their initial share of the surplus. There, it is important that the agent can still leave without costs. Thus, the contract must at least pay the outside option in any future period.[8]

This setup dictates that the agent's first-period utility U_1^r, which accounts for the fact that he anticipates choosing the virtual path in period 2, must satisfy the following condition:

[8]This feature is different from Miller and Watson (2013) and Fahn (2017). In these papers, the inability of parties to commit not to renegotiate any agreement undermines the efficiency of long-term employment relationships.

$$\begin{aligned} U_1^r \geq &\overline{u} + (1-\alpha)(e_1\theta - c(e_1) - \overline{u}) \\ &+ \beta\left[\overline{u} + (1-\alpha)\left(e_2^v\theta - c(e_2^v) - \overline{u} + K\right)\right. \\ &\left.+ \left(\overline{u} + (1-\alpha)\left(e_3^v\theta - c(e_3^v) - \overline{u} + K\right)\right)\right]. \end{aligned}$$

The rest of the analysis resembles that in Section 4; in particular, all other constraints are identical. Consequently, the principal still offers a menu in period 2 that shifts a major part of the compensation to the third period of the virtual path. It also remains optimal (a) to promise the agent the entire third-period surplus, (b) to reduce w_1^r accordingly, and (c) to set all effort levels to the first best. Therefore, Proposition 4 emerges.

Proposition 4. *Assume that in period 1, the agent can secure a share* $(1-\alpha)$ *of the total relationship surplus from his perspective. Then, we obtain*

$$\begin{aligned} w_1^r = &\overline{u} + c(e^{FB}) - \beta(1-\beta)\left(e^{FB}\theta - c(e^{FB}) - \bar{u} + K\right) \\ &+ (1-\alpha)\left(e^{FB}\theta - c(e^{FB}) - \bar{u}\right) \\ &+ 2\beta(1-\alpha)\left(e^{FB}\theta - c(e^{FB}) - \bar{u} + K\right). \end{aligned}$$

$$\frac{\partial^2 w_1^r}{\partial\alpha\partial K} = -2\beta.$$

The first line of w_1^r in Proposition 4 contains the wage when the agent lacks bargaining power. By contrast, the second line represents the agent's share of the first-period surplus (which does not include K). Lastly, the third line reflects his share of the second- and third-period surplus. The proposition indicates that the adverse effects of higher firing costs on the wages of young employees are more pronounced for agents with lower bargaining power. This insight follows from the fact that smaller values of α increase the utility the agent is bound to receive anyway in future periods. But then, the principal struggles more to further boost the agent's virtual rent in period 3 (compared to the main case where she has full bargaining power). Consequently, she is also less able to decrease w_1^r.

Taken at face value, the finding implies that stricter employment protection laws disproportionately harm workers with relatively low bargaining power. Indeed, Leonardi and Pica (2013) find that the detrimental effect of higher firing costs on wages is larger for workers with low bargaining power. Examples include young blue-collar workers or workers with earnings just above the sectoral contractual minimum compensation.

6.3 Partial Naiveté

Our main model assumes the agent is fully naive. Now, we show that our results remain unchanged even if the agent perceives his future present bias parameter to be $\hat{\beta} \in (\beta, 1]$. The reason is that $\hat{\beta}$ only affects two constraints: first, the agent's (IR) constraint in the second period when choosing the virtual career path (from his first-period perspective) and, second, the (vC) constraint. The latter constraint ensures the agent's first-period self finds it optimal to choose the virtual path in the second period. For all other constraints, only the true β matters. However, these two constraints were slack in the original problem, and we can show that they also hold for the wages and effort levels derived in Section 4.2 with a general $\hat{\beta}$. Therefore, for a given β, the contract does not depend on the agent's degree of naiveté, unless he is fully sophisticated and $\hat{\beta} = \beta$. Note that such a discontinuity is a common feature of other models in the literature (Heidhues and Kőszegi, 2010).

7 Discussion and Conclusion

We have shown that employment protection laws can have unintended consequences because they allow firms to better exploit naive, present-biased employees. This finding emerges because the optimal exploitation contract involves a dynamic career path with a virtual career path (which the agent expects to choose in the future) and the real path (that he ends up selecting inadvertently). Higher firing costs increase a firm's commitment when promising future (virtual) compensation, allowing for a larger wage reduction early on.

Our analysis has focused on the consequences of "pure" firing costs and ignored severance payments (i.e., payments from the firm to the worker upon a separation). Lazear (1990) argues that firms could pass severance payments onto workers by paying them lower wages or posting a performance bond. Thereby, they would not affect total labor costs. Still, the literature has also mostly considered firing costs as a tax on job destruction (Bertola and Rogerson, 1997; Betcherman, 2013), arguing that, in practice, wage-setting mechanisms and financial market imperfections may not weaken this link and not allow firms to lower wages (Martin and Scarpetta, 2012). However, as demonstrated by Leonardi and Pica (2013), firing costs can indeed dampen the wages of (in particular, new) workers, even if they do not allow workers to secure higher wages later on. Our paper has demonstrated that such an observation can occur even if firing costs take the form of a tax, namely because of the profit-maximizing exploitation contract firms offer to naive, present-biased employees.

Finally, we briefly discuss how a severance payment would affect our results, assuming that the agent also receives it if he chooses to leave in periods $t = 2, 3$, which effectively increases his outside option. If principals paid severance payments only after firing the agent (and courts were able to verify that), severance payments would not affect our results.

Then, only the cost component – not the amount captured by the agent – affects the virtual path: in period $t = 3$, the principal optimally promises a high rent, which is solely determined by her termination costs. In period 2, the qualification period, effort requirements can be adjusted to have it sufficiently unattractive, no matter how much the agent would be paid if he is laid off. Nevertheless, severance payments affect the real path (in periods $t = 2, 3$, the agent's real compensation is determined by his effective outside option), which is costly for the principal but not anticipated by the agent. Therefore, the agent is only willing to accept an early-career wage reduction for the costly component to the principal, not for the higher payment he can extract in later stages of his career.

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A Appendix: Omitted Proofs

Proof to Proposition 1 The objective is to maximize

$$\Pi_1 = e_1^r\theta - w_1^r + e_2^r\theta - w_2^r + e_3^r\theta - w_3^r,$$

subject to

$$
\begin{array}{ll}
\text{(IRA1)} & w_1^r - c(e_1^r) + \beta\left(w_2^v - c(e_2^v) + w_3^v - c(e_3^v)\right) \geq \bar{u} + 2\beta\bar{u} \\
\text{(rIRA2)} & w_2^r - c(e_2^r) + \beta\left(w_3^r - c(e_3^r)\right) \geq \bar{u} + \beta\bar{u} \\
\text{(rIRA3)} & w_3^r - c(e_3^r) \geq \bar{u} \\
\text{(vIRA2)} & w_2^v - c(e_2^v) + w_3^v - c(e_3^v) \geq 2\bar{u} \\
\text{(vIRA3)} & w_3^v - c(e_3^v) \geq \bar{u} \\
\text{(vIRP2)} & w_2^v - e_2^v\theta + w_3^v - e_3^v\theta \leq K \\
\text{(vIRP3)} & w_3^v - e_3^v\theta \leq K \\
\text{(rC)} & w_2^r - c(e_2^r) + \beta\left(w_3^r - c(e_3^r)\right) \geq w_2^v - c(e_2^v) + \beta\left(w_3^v - c(e_3^v)\right) \\
\text{(vC)} & w_2^v - c(e_2^v) + w_3^v - c(e_3^v) \geq w_2^r - c(e_2^r) + w_3^r - c(e_3^r)
\end{array}
$$

For the following, we omit the constraints (vIRA2), (vIRA3), (vIRP2) and (vC), and check ex post whether they hold for the derived contract.

First, (rIRA) binds. If it did not bind, we could reduce w_1^r without violating any constraint. This yields

$$w_1^r = c(e_1^r) + \bar{u} + \beta\left(c(e_2^v) + \bar{u} - w_2^v + c(e_3^v) + \bar{u} - w_3^v\right),$$

and the "new" optimization problem that maximizes

$$
\begin{aligned}
\Pi_1^r = & e_1^r\theta - c(e_1^r) - \bar{u} - \beta\left(c(e_2^v) + \bar{u} - w_2^v + c(e_3^v) + \bar{u} - w_3^v\right) \\
& + e_2^r\theta - w_2^r + e_3^r\theta - w_3^r,
\end{aligned}
$$

subject to

(rIRA2) $$w_2^r - c(e_2^r) + \beta\left(w_3^r - c(e_3^r)\right) \geq \bar{u} + \beta\bar{u}$$

(rIRA3) $$w_3^r - c(e_3^r) \geq \bar{u}$$

(vIRP3) $$w_3^v \leq K + e_3^v\theta$$

(rC) $$w_2^r - c(e_2^r) + \beta\left(w_3^r - c(e_3^r)\right) \geq w_2^v - c(e_2^v) + \beta\left(w_3^v - c(e_3^v)\right).$$

Second, we show that the constraints (rIRA2), (rIRA3), and (rC) bind. To the contrary, assume that (rC) is slack. Then, the principal can increase w_2^v, which increases profits but does not violate any constraint. Furthermore, if (rIRA2) is slack, the principal can reduce both, w_2^r and w_2^v, by a small ε. Thereby, (rC) remains satisfied, whereas profits increase by $(1-\beta)\,\varepsilon$. Finally if (rIRA3) is slack, the principal can reduce reduce w_3^r and w_3^v by a small ε. Thereby, (rC) remains satisfied, whereas profits increase by $(1-\beta)\,\varepsilon$.

Using these results yields

$$\begin{aligned}
w_2^r &= c(e_2^r) + \bar{u} \\
w_3^r &= c(e_3^r) + \bar{u} \\
w_2^v &= c(e_2^v) + \bar{u} - \beta\left(e_3^v\theta - c(e_3^v) - \bar{u} + K\right),
\end{aligned}$$

and the optimization problem maximizes

$$\begin{aligned}
\Pi_1^r =& e_1^r\theta - c(e_1^r) - \bar{u} + e_2^r\theta - \bar{u} - c(e_2^r) + e_3^r\theta - c(e_3^r) - \bar{u} \\
& - \beta\left[\beta\left(e_3^v\theta - c(e_3^v) - \bar{u} + K\right) + c(e_3^v) + \bar{u} - w_3^v\right]
\end{aligned}$$

subject to

(vIRP3) $$w_3^v \leq K + e_3^v\theta.$$

Since Π_1^r increases in w_3^v, (vIRP3) binds as well, and profits are

$$\begin{aligned}
\Pi_1^r =& e_1^r\theta - c(e_1^r) - \bar{u} + e_2^r\theta - \bar{u} - c(e_2^r) + e_3^r\theta - c(e_3^r) - \bar{u} \\
& + \beta\,(1-\beta)\left(e_3^v\theta - c(e_3^v) - \bar{u} + K\right).
\end{aligned}$$

It immediately follows that $e_1^r = e_2^r = e_3^r = e_3^v = e^{FB}$. Moreover, since e_2^v only enters $w_2^v = c(e_2^v) + \bar{u} - \beta\left(e_3^v\theta - c(e_3^v) - \bar{u} + K\right)$, it is without loss to set $e_2^v = e^{FB}$ as well.

Taking these results into account yields

$$
\begin{aligned}
w_1^r &= c(e^{FB}) + \bar{u} - \beta\,(1-\beta)\left(e^{FB}\theta - c(e^{FB}) - \bar{u} + K\right) \\
w_2^r &= c(e^{FB}) + \bar{u} \\
w_3^r &= c(e^{FB}) + \bar{u} \\
w_2^v &= \bar{u} + c(e^{FB}) - \beta\left(e^{FB}\theta - c(e^{FB}) - \bar{u} + K\right) \\
w_3^v &= K + e^{FB}\theta
\end{aligned}
$$

Finally, we have to confirm that these outcomes satisfy the omitted constraints we omit the constraints (vIRA2), (vIRA3), (vIRP2) and (vC). These conditions become

$$
\begin{aligned}
&\text{(vIRA2)} && (1-\beta)\left(e^{FB}\theta - c(e^{FB}) - \bar{u} + K\right) \geq 0 \\
&\text{(vIRA3)} && e^{FB}\theta - c(e^{FB}) - \bar{u} + K \geq 0 \\
&\text{(vIRP2)} && \left(e^{FB}\theta - c(e^{FB}) - \bar{u}\right) + \beta\left(e^{FB}\theta - c(e^{FB}) - \bar{u} + K\right) \geq 0 \\
&\text{(vC)} && (1-\beta)\left(e^{FB}\theta - c(e^{FB}) - \bar{u} + K\right) \geq 0,
\end{aligned}
$$

and clearly hold.

Finally, plugging effort and wages into the payoff functions yields

$$
\begin{aligned}
U_1^r &= (1+2\beta)\bar{u} - \beta\,(1-\beta)\left(e^{FB}\theta - c(e^{FB}) - \bar{u} + K\right) \\
\tilde{U}_1^r &= 3\bar{u} - \beta\,(1-\beta)\left(e^{FB}\theta - c(e^{FB}) - \bar{u} + K\right) \\
\Pi_1^r &= 3\left(e^{FB}\theta - c(e^{FB}) - \bar{u}\right) + \beta\,(1-\beta)\left(e^{FB}\theta - c(e^{FB}) - \bar{u} + K\right).
\end{aligned}
$$

■

Proof to Proposition 3 The structure of the profit-maximizing contract is very similar to that from Proposition 1, only a lower bound on wages, $w \geq \bar{w}$, must be satisfied. Most importantly, the agent's first-period (IRA) constraint still holds as an equality because otherwise, the principal could increase e_1^r without violating any constraint. The rest proceeds accordingly to the proof of Proposition 1, and generates the results stated in Proposition 3.

■