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Abstract

Workers on temporary contracts search for jobs while holding one. This paper models the transition out of temporary employment from the worker's perspective. A worker on a job with a known end date divides her time between effort, which is rewarded now and raises the quality of the next job, and search, which determines whether the transition happens at all. Because search claims hours that effort would otherwise fill, the worker lets her human capital depreciate on the temporary job and possibly experiences a pay cut at the transition. Yet welfare rises in every parameter of the model. The depreciation and the possible pay cut are the price the worker optimally pays for her chance of a permanent job.

Keywords: Temporary employment; on-the-job search; human capital; time allocation.

JEL Classification: J22; J24; J41; J62

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1 Introduction

A well-established empirical regularity in European labor markets is that workers on temporary contracts search for jobs while holding one. In every longitudinal study surveyed by Boeri and Garibaldi (2024), the incidence of on-the-job search is higher among temporary workers than among holders of open-ended contracts, and the gap holds in every European country for which comparable data exist. As temporary employment has grown,[1] the behavior has become a quantitatively important feature of labor markets.

The phenomenon is starkest where temporary contracts are both widespread and unwanted. In Italy and Spain, two large economies with among the highest incidences of fixed-term employment in the EU, more than half of temporary employees aged 25 to 64 reported in 2024 that they held a fixed-term contract because they could not find a permanent job. The pattern is not an artifact of age. The share remains close to one half even among workers aged 15 to 29, with fewer than one in five of them citing education or training as the reason for their temporary contract.[2]

Search from a temporary job is costly. Time devoted to finding the next position is time not devoted to the current one, and the current one is where human capital is built or left to depreciate. This paper provides a theoretical model of the transition out of temporary employment from the worker's perspective. The model is deliberately simple, featuring two periods and closed forms throughout. A worker on a job with a known end date allocates working time between effort, which is rewarded now and raises the quality of the next job, and search, which determines whether the transition happens at all. The probability of reaching a permanent position is thus a choice, and the model discusses its implications in terms of human capital, pay across jobs, and the worker's own welfare.

The model delivers three results. First, at any interior optimum the worker sets effort below the level that maintains her human capital. Depreciation of human capital on the temporary job is thus not a possibility but a property of the solution, the direct consequence of search competing with effort for working time. Second, while effort increases unambiguously with its current payoff, its responses to the future payoff, earned through the quality of the next job, and to patience are ambiguous. But the model organizes the ambiguity completely, and shows that in most configurations of the relevant parameters, effort rises with both the future payoff and patience. Third, the model signs the change

[1] Boeri and Garibaldi (2024) report that the share of temporary employment in dependent employment has nearly doubled in the European Union (EU) over the last forty years.

[2] Own calculations based on Eurostat's *Temporary employees by main reason*, available at `https://doi.org/10.2908/LFSA_ETGAR`. The incidence of temporary contracts is from Eurostat's *Temporary employees as percentage of the total number of employees*, available at `https://doi.org/10.2908/TESEM110`.

in pay across the two jobs. Pay falls at the transition when the future payoff to effort exceeds the current one, and rises in the opposite case. Yet – whichever way pay moves, and even as human capital shrinks – the worker's welfare rises in every parameter of the model. The depreciation, and the possible pay cut, are the price the worker optimally pays for her chance of a permanent job.

Contribution to the literature The paper speaks to three strands of literature. The first is the theory of temporary employment, which has approached contracts of finite duration almost exclusively from the firm's side. The typical model is a search framework in which firms decide which contracts to post (e.g. Berton and Garibaldi, 2012), whether to convert them into permanent positions (e.g. Blanchard and Landier, 2002), and how to respond to firing costs (e.g. Charlot and Malherbet, 2013). Where the worker chooses at all, the choice concerns search intensity (Alonso-Borrego et al., 2005) or whether to take up, and when to leave, a bad temporary job (Browning et al., 2007). Effort on the temporary job appears in Güell and Rodríguez Mora (2010) as a classical efficiency-wage story in the tradition of Shapiro and Stiglitz (1984). Effort is imperfectly observed there, and wages and the renewal of the contract into a permanent one are the firm's disciplining instruments. In these models the effort margin, where it exists, is the firm's problem. Here it is the worker's. She sets effort freely, and what limits her is not discipline but time.

The second strand combines on-the-job search with human capital accumulation over the career. Human capital accumulates as a by-product of employment (Bagger et al., 2014; Lise and Postel-Vinay, 2020) or through training whose intensity is optimally chosen by firms (Fu, 2011; Lentz and Roys, 2024). In none of these models does the worker face a working day to divide. Training costs money or nothing, and search costs no working time. In this paper, human capital is built by effort, effort takes hours, and every hour of search is an hour of effort forgone.

The third strand documents and explains the human capital gap of temporary workers, who receive less formal training (Booth et al., 2002; Finegold et al., 2005), encounter fewer opportunities to learn at work (Kauhanen and Nätti, 2015), and are assigned tasks of lower skill content (Kahn, 2018) than permanent workers. The gap arises at different points of the career. Firms fund training when they expect to capture its returns within the match (Acemoglu and Pischke, 1998), and a match expected to end soon leaves little to capture. Workers invest less in education before entering the market when short and unstable jobs reduce its expected return (Charlot and Malherbet, 2013). And skills decay in the spells of non-employment between jobs (Edin and Gustavsson, 2008). The model adds a fourth mechanism, which is the temporary worker's own optimal allocation of time. Human capital is lost because the effort that builds it and the search for the next job compete within the same working day.

2 Model

Consider an individual who lives over two periods, 1 and 2. In period 1, she is employed on a temporary basis. The individual chooses her total working time $h_1 \in [0,1]$, which she allocates between on-the-job effort e_1 and search for a job with undetermined duration, s. Total working time entails a convex disutility $v(h_1)$, which captures the opportunity cost of forgone leisure.

The individual's lifetime expected utility is equal to:

$$U = w_1 (j_1, e_1) - v (h_1) + \delta f (s) w_2 (j_2, k_1) \quad (1)$$

where w_t is the wage earned at time t (with $t = 1, 2$), j is an index of job quality, e_1 is the effort exerted on the period 1 job, and k_1 is the individual's initial stock of human capital. The parameter $\delta \in (0, 1)$ is a discount factor, and $f(s)$ is the probability of finding a period 2 job, increasing in the time devoted to job search at time 1, s, so that $\partial f / \partial s > 0$.

In (1), each wage is written on what exists and is observed at its respective contracting date. In period 1, effort is assumed to be perfectly observed by the employer. There is no moral hazard in this model, and the wage can be conditioned on effort directly, alongside the quality of the current job, so $w_1 = w_1(j_1, e_1)$. The friction is not informational but temporal, as effort competes with search for working time.[3] At the period 2 hiring, the observables are the quality of the position obtained and the stock of human capital the worker brings to it, so $w_2 = w_2(j_2, k_1)$. The initial stock k_1 consists of what the worker carries into the temporary job, such as education and training. It is exogenous and observable to employers at hiring. Both wages are increasing in their arguments, with $\partial w_1/\partial j_1 > 0$, $\partial w_1/\partial e_1 > 0$, $\partial w_2/\partial j_2 > 0$, and $\partial w_2/\partial k_1 > 0$.

I assume that job quality j is a function of human capital k, which captures the worker's accumulated productive capacity, as distinct from calendar tenure:

$$j_t = j_t (k_t) \quad (2)$$

for $t = 1, 2$, with $\partial j/\partial k > 0$. The level of human capital in period 2 is assumed to depend on initial

[3] Beyond this, full observability of effort has three further defenses. First, the standard instrument for disciplining unobserved effort on a temporary contract is the renewal of the contract itself (Güell and Rodríguez Mora, 2010). On a contract that ends by assumption, that instrument does not exist, and it is not needed. Effort is paid within the period, so the worker supplies it for its price rather than to secure renewal. Second, temporary employment concentrates in jobs whose output is highly measurable – deliveries made, calls completed, shifts covered – so that observed effort is a reasonable description of these jobs. Third, the allocation of time under full information is the canonical problem of the life-cycle human capital tradition, from Ben-Porath (1967) and Heckman (1976) to Imai and Keane (2004).

human capital and period 1 effort: $k_2 = k_2(k_1, e_1)$, with $\partial k_2/\partial k_1 > 0$ and $\partial k_2/\partial e_1 > 0$. The equation describing the period 2 job is therefore:

$$j_2 = j_2\left(k_1, e_1\right) \tag{3}$$

Since search time is residually determined by the choice of total hours and effort, it can be written as:

$$s = h_1 - e_1 \tag{4}$$

so that $\partial s/\partial e_1 = -1 < 0$ and $\partial s/\partial h_1 = 1 > 0$.

Using (2), (3), and (4), I can rewrite expected utility (1) as:

$$U = w_1\left(k_1, e_1\right) - v\left(h_1\right) + \delta f\left(h_1 - e_1\right) w_2\left(k_1, e_1\right) \tag{5}$$

Utility maximization with respect to e_1 and h_1 yields two optimality conditions. The first-order condition for effort is:

$$\frac{\partial w_1}{\partial e_1} + \delta f \frac{\partial w_2}{\partial e_1} - \delta w_2 \frac{\partial f}{\partial s} = 0 \tag{6}$$

(where I have used (4)). Condition (6) states that, at the optimum, the marginal benefits of effort exactly offset its marginal cost. A marginal increase in effort raises the period 1 wage by $\partial w_1/\partial e_1$ and, by improving the quality of the next job, raises the period 2 wage by $\partial w_2/\partial e_1$, collected with probability f and discounted. Against these gains stands the cost of effort in this model, which is not disutility but forgone search, as the marginal hour of effort is an hour not spent searching. It lowers the probability of finding a period 2 job, and thereby puts the whole period 2 wage w_2 at risk.

The first-order condition for hours is:

$$\frac{\partial v}{\partial h_1} = \delta w_2 \frac{\partial f}{\partial s} \tag{7}$$

(always using (4)). Condition (7) states that the individual works up to the point where the marginal disutility of time at work equals the discounted expected gain from the marginal hour allocated to search.

2.1 Functional forms

Let job quality be linear in human capital, $j_t(k_t) = k_t$ for $t = 1, 2$. Furthermore, period 2 human capital is the product of initial human capital and period 1 effort:

$$k_2 = k_1 e_1 \tag{8}$$

Under this form, effort is the factor by which human capital carries over across periods. This has two implications. First, since $\partial^2 k_2 / \partial k_1 \partial e_1 > 0$, effort and human capital are complements, as the same effort yields more period 2 human capital, the larger the initial stock. Second, $e_1 = 1$ is a maintenance level.[4] Effort at one maintains human capital, while effort below one lets it depreciate.[5]

The probability of finding a period 2 job is linear in search time: $f(s) = s$, so that $\partial f / \partial s = 1$.

The wage schedules are linear. In period 1, the wage has two components, both proportional to the quality of the current job. The first is a base component, independent of the worker's behavior. The second is a return to effort:

$$w_1 = \alpha j_1 + \beta j_1 e_1 \tag{9}$$

The complementarity between job quality and effort in the second component reflects the fact that a given amount of effort is better rewarded on a higher-quality job. In period 2, the wage rewards the quality of the position obtained and the stock the worker presents at hiring:

$$w_2 = \alpha j_2 + \beta k_1 \tag{10}$$

Substituting the functional forms, the two schedules become $w_1 = k_1(\alpha + \beta e_1)$ and $w_2 = k_1(\alpha e_1 + \beta)$, with $\alpha > 0$ and $\beta > 0$. Per unit of initial capital, period 1 pay has effort-independent component α and return to effort β. Period 2 pay has effort-independent component β and return to effort α.[6] The parameters thus exchange roles across periods, the reward to effort being β today and α tomorrow.[7]

[4] Jointly with the unit time endowment, the normalization is substantive. Since $e_1 \leq h_1 \leq 1$, maintaining human capital absorbs the entire working day, and the margin the model studies is maintenance against depreciation, not accumulation against depreciation. This is the intended reading of a temporary job, whose tasks are generally of lower skill content than those of a permanent position.

[5] I considered and discarded the additive alternative $k_2 = k_1 + e_1$ on two grounds. Substantively, under the additive form any positive effort grows human capital, so human capital depreciation, a central question here, is impossible by construction. Analytically, the additive form breaks the structure of the results, in particular the regime characterization of Corollary 1.

[6] Survey evidence is consistent with effort on temporary jobs having an investment motive. Engellandt and Riphahn (2005) find that temporary workers are substantially more likely to work unpaid overtime, which they interpret as effort aimed at securing subsequent permanent employment.

[7] This is not a coincidence of the parametrization but the contracting principle at work. Each wage rewards job quality and the worker's date-specific contribution, at the same two rewards α and β in both periods. Since effort builds the capital that becomes the next job's quality, the contribution rewarded at β today is rewarded again, as quality, at α tomorrow.

In what follows, a central role is played by the product $\rho \equiv \delta\alpha$, the discounted reward that today's effort earns tomorrow.

To simplify the exposition, I set $k_1 = 1$.[8] Consequently, $j_1 = k_1 = 1$ and $j_2 = k_2 = e_1$, and the two wage schedules become:

$$w_1 = \alpha + \beta e_1 \tag{11}$$

$$w_2 = \alpha e_1 + \beta \tag{12}$$

Finally, the disutility of working time is quadratic:

$$v(h_1) = h_1^2/2 \tag{13}$$

so that the marginal disutility of time at work, $\partial v/\partial h_1 = h_1$, is increasing in hours worked. This assumption buys every closed form in the paper.

2.2 Solution

Using $\partial v/\partial h_1 = h_1$ and $\partial f/\partial s = 1$, condition (7) yields the optimal level of hours as a function of effort:

$$h_1 = \delta w_2 = \delta\left(\alpha e_1 + \beta\right) \tag{14}$$

Substituting (11), (12), and (14) into (6) and solving yields the optimal level of effort:

$$e_1^* = \frac{\beta\left[1 - \delta\left(1 - \rho\right)\right]}{\rho\left(2 - \rho\right)} \tag{15}$$

and, substituting back into (14) and (4), the optimal levels of hours and search:

$$h_1^* = \frac{\beta\left(1 + \delta\right)}{2 - \rho} \tag{16}$$

$$s^* = \frac{\beta\left(\delta + \rho - 1\right)}{\rho\left(2 - \rho\right)} \tag{17}$$

Proposition 1. *Assume $\rho < 2$, $\beta(1+\delta) < 2 - \rho$, and $\delta + \rho > 1$. Then the program of maximizing* (5) *has a unique solution (e_1^*, h_1^*), given by* (15) *and* (16)*, and it satisfies $0 < e_1^* < h_1^* < 1$. The implied search time*

[8] The normalization is without loss of generality. Appendix D solves the model with k_1 free and shows that every result holds unchanged under the generalized definition $\widetilde{\rho} \equiv \delta\alpha k_1$.

s^*, given by (17)*, lies in* $(0, 1)$.

Proof See Appendix A.

Optimal effort is always positive as long as $\rho < 2$, that is, as long as the discounted reward to effort is not so large that the problem ceases to be well behaved. Indeed, $\rho < 2$ is also the second-order condition, as Appendix A shows. Effort is also proportional to β, its within-period reward. Doubling the reward doubles the effort. Optimal hours are likewise positive under $\rho < 2$ and proportional to β. Search is positive if and only if $\delta + \rho > 1$. The worker diverts working time from the job she holds only if the future weighs enough, that is, if patience and the discounted reward to effort are high enough.

The chain of inequalities in Proposition 1 implies that whenever search is worthwhile, effort cannot exhaust working time, so $e_1^* < 1$ and, by (8), $k_2 < k_1$. Human capital depreciates on the temporary job. The model therefore predicts underinvestment in human capital – effort optimally set below the maintenance level – as a consequence of search crowding out effort within working time.[9] As Section 2.3 shows, however, the worker's welfare rises with the very parameters that deepen the depreciation.

One further property of the solution is that the two shares of the working day, $\sigma_e \equiv e_1^*/h_1^*$ (the fraction of working time devoted to effort) and $\sigma_s \equiv s^*/h_1^*$ (the fraction devoted to search), depend only on α and δ, not on β. Using (15), (16), and (17):

$$\sigma_e = \frac{1 - \delta\,(1 - \rho)}{\rho\,(1 + \delta)} \qquad\qquad \sigma_s = \frac{\delta + \rho - 1}{\rho\,(1 + \delta)} \tag{18}$$

where $\sigma_e + \sigma_s = 1$ by (4).

2.3 Comparative statics

Proposition 2 shows that hours and search respond monotonically to all three parameters: the reward to effort today, β; its reward tomorrow, α; and the discount factor δ. Effort itself rises with its current reward β. Effort's responses to α and to δ, by contrast, can take either sign, depending on α and δ but not on β. The proposition also covers the composition of the working day. The shares in (18) move monotonically toward search, and away from effort, as either α or δ rises.

[9] Depreciation of human capital also implies $j_2 < j_1$, but this is not a statement about which job is better. By (2), j simply tracks k, while the period 2 job is preferred for its duration, which is what search purchases.

Proposition 2. Under the conditions of Proposition 1:

(*i*) *h_1^* and s^* are strictly increasing in β, α, and δ.*

(*ii*) *e_1^* is strictly increasing in β.*

(*iii*) *e_1^* is strictly increasing in α if and only if $\delta\rho^2 > 2(1-\delta)(1-\rho)$.*

(*iv*) *e_1^* is strictly increasing in δ if and only if $\rho(2+\delta) > 2$.*

(*v*) *σ_s is strictly increasing in α and in δ, while $\sigma_e = 1 - \sigma_s$ is strictly decreasing in both.*

Proof See Appendix B.

Parts (i), (ii), and (v) are unambiguous. A higher reward to effort – today's, β, or tomorrow's, α – and greater patience all lengthen working time and intensify search. A higher β raises effort itself. The composition of the day tilts toward search whenever α or δ rises. All the model's subtlety concentrates in parts (iii) and (iv).

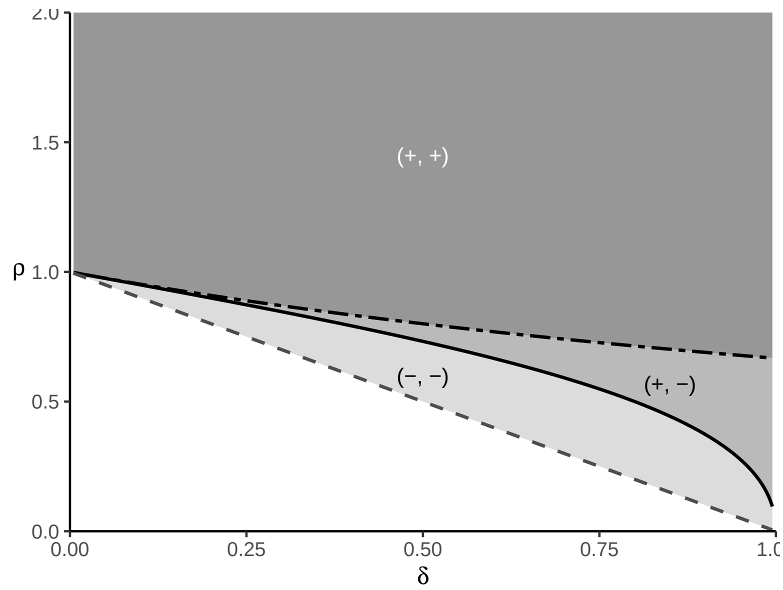
The thresholds in parts (iii) and (iv) are not independent, as the next corollary records.

Corollary 1. *Define $\tau \equiv \delta\rho^2 - 2(1-\delta)(1-\rho)$ and $\psi \equiv \rho(2+\delta) - 2$. Both are strictly increasing in ρ, and $\tau > 0$ whenever $\psi \geq 0$. The (ρ, δ) plane is therefore partitioned into three regimes: e_1^* decreasing in both α and δ, increasing in α but decreasing in δ, and increasing in both α and δ. The configuration in which e_1^* decreases in α while increases in δ cannot arise. Furthermore, $\rho \geq 1$ is sufficient for e_1^* to be increasing in both α and δ.*

Proof See Appendix C.

Corollary 1 imposes structure on the ambiguities of Proposition 2, and Figure 1 displays it. The solid curve is the locus $\tau = 0$, while the two-dashed curve is the locus $\psi = 0$. By parts (iii) and (iv) of Proposition 2, the corresponding derivative of effort is positive above each curve. Since the solid curve lies everywhere below the two-dashed one, moving up the figure, raising ρ at given δ, crosses the two curves in a fixed order. Effort's response to α turns positive first, its response to δ later. The plane thus splits into the three shaded regimes, and a fourth configuration, $(-,+)$, would require a point below the solid curve yet above the two-dashed one, which does not exist. On the line $\rho = 1$ and above it (the line is not drawn), the figure is entirely dark grey. Effort's responses to both α and δ are positive, as the corollary's sufficiency condition states.

Figure 1: Visualization of claim in Corollary 1



Notes: The two-dashed curve is the locus $\psi = 0$, the solid curve the locus $\tau = 0$, in the (δ, ρ) plane. Each area's label reports the signs of $(\partial e_1^* / \partial \alpha, \partial e_1^* / \partial \delta)$ in that region: $(-, -)$ in the light grey area, $(+, -)$ in the mild grey area, and $(+, +)$ in the dark grey area. The configuration $(-, +)$ cannot arise. The straight dashed line is the locus $\delta + \rho = 1$. By the condition $\delta + \rho > 1$ of Proposition 1, any admissible (δ, ρ) pair lies strictly above it. Any $\rho \geq 1$ guarantees $\partial e_1^* / \partial \alpha > 0$ and $\partial e_1^* / \partial \delta > 0$.

2.4 Welfare and wage changes

Welfare The measure of welfare is the individual's indirect utility, that is, the value of (5) at the optimum. Substituting (11), (12), (13), and (14) into (5) and evaluating at e_1^* yields:

$$U^* = (\alpha + \beta e_1^*) + \frac{\delta^2}{2} (\alpha e_1^* + \beta)^2 - \delta e_1^* (\alpha e_1^* + \beta) \tag{19}$$

Lifetime welfare is strictly positive.[10] The welfare comparative statics stand in contrast with the behavioral ones. Differentiating (19) holding e_1^* fixed by the envelope theorem, and using $\delta(\alpha e_1^* + \beta) - e_1^* = h_1^* - e_1^* = s^*$ by (14) and (4), yields:

$$\frac{\partial U^*}{\partial \beta} = e_1^* + \delta s^* \qquad \frac{\partial U^*}{\partial \alpha} = 1 + \delta e_1^* s^* \qquad \frac{\partial U^*}{\partial \delta} = s^* (\alpha e_1^* + \beta) \tag{20}$$

These three derivatives are strictly positive at any interior optimum. The individual always benefits from a higher reward to effort, today's or tomorrow's, and from greater patience, including in the regimes of Proposition 2 in which her effort falls. A decline in effort following a rise in α or δ is a reallocation toward search, not a loss.

[10]Substituting (15) into (19) and simplifying yields $U^* = \alpha + \beta^2[2\delta\rho + (1-\delta)^2]/[2\rho(2-\rho)]$. The assumption $\rho < 2$ from Proposition 1 is sufficient for this expression to be strictly positive.

Wage change across jobs The solution also pins down an observable: the change in pay across the two jobs, $\omega \equiv w_2^* - w_1^*$.[11] Using (11) and (12), this equals:

$$\omega = (\beta - \alpha)\,(1 - e_1^*) \tag{21}$$

By Proposition 1 and the discussion following it, $e_1^* < 1$. Thus, the second factor in (21) is strictly positive, and

$$\text{sign}\ \omega = \text{sign}\,(\beta - \alpha)$$

Pay rises across jobs if and only if $\beta > \alpha$, that is, if and only if today's reward to effort exceeds tomorrow's reward. To see why, recall $w_1^* = \alpha + \beta e_1^*$ and $w_2^* = \alpha e_1^* + \beta$. In period 1 it is β that is scaled by effort; in period 2 it is α. Since $e_1^* < 1$, the scaled reward is the diminished one. The second wage therefore exceeds the first exactly when the reward it diminishes is the smaller of the two, that is, when $\alpha < \beta$.[12]

The wage change also inherits a comparative static from effort. Since $\alpha - \beta$ does not depend on δ, differentiating (21) gives:

$$\frac{\partial \omega}{\partial \delta} = (\alpha - \beta)\,\frac{\partial e_1^*}{\partial \delta}$$

so, by part (iv) of Proposition 2, ω is increasing in δ if and only if $\alpha - \beta$ and ψ share their sign.

3 A special case: $\rho = 1$

On the locus $\rho = 1$, where the discounted reward that today's effort earns tomorrow equals unity, the model collapses to elementary expressions. The solution becomes:

$$e_1^* = \beta \qquad\qquad s^* = \beta\delta \qquad\qquad h_1^* = \beta\,(1 + \delta) \tag{22}$$

Effort equals its current reward. Search equals effort, discounted. And hours are their sum. In this special case, the shares in (18) depend only on the discount factor δ:

$$\sigma_e = \frac{1}{1+\delta} \qquad\qquad \sigma_s = \frac{\delta}{1+\delta}$$

[11] I work with the difference rather than the ratio w_2^*/w_1^* because the difference factorizes cleanly, as (21) shows. The choice is immaterial. Since $w_1^* > 0$, dividing preserves signs, and $\omega > 0 \iff w_2^*/w_1^* > 1 \iff \ln(w_2^*/w_1^*) > 0$.

[12] Wage declines at the transition are consistent with existing theory. In models with employment protection, workers partly prepay the value of job security through lower negotiated compensation (Lazear, 1990; Mortensen and Pissarides, 1999).

with $\partial\sigma_e/\partial\delta = -1/(1+\delta)^2 < 0$ and $\partial\sigma_s/\partial\delta = 1/(1+\delta)^2 > 0$. Greater patience tilts the day toward search, one for one against effort.

By Corollary 1, at $\rho = 1$, $\tau = \psi = \delta > 0$, so effort is increasing in both α and δ.

The comparative statics for welfare inherit the signs of the general case. Substituting (22) into (20), welfare strictly increases in β ($\partial U^*/\partial\beta = \beta(1+\delta^2) > 0$), in α ($\partial U^*/\partial\alpha = 1 + (\beta\delta)^2 > 0$), and in δ ($\partial U^*/\partial\delta = \beta^2(1+\delta) > 0$).

The wage change is negative throughout the locus. Substituting $e_1^* = \beta$ and $\alpha = 1/\delta$ into (21):

$$\omega = -\frac{(1-\beta)\,(1-\beta\delta)}{\delta}$$

Both factors in the numerator are positive. To see this, note that at $\rho = 1$, the three interiority conditions of Proposition 1 collapse. The conditions $\rho < 2$ and $\delta + \rho > 1$ become $1 < 2$ and $1 + \delta > 1$ (both always true), and $\beta(1+\delta) < 2 - \rho$ becomes the single requirement $\beta < 1/(1+\delta)$. Since $\beta < 1/(1+\delta) < 1$, then $\beta < 1$ and therefore $\beta\delta < 1$. Hence $\omega < 0$, that is, pay always falls across jobs.

4 Conclusions

This paper has provided a theoretical model of the transition out of temporary employment from the worker's perspective. A worker on a job with a known end date divides her working time between effort, which is rewarded now and raises the quality of the next job, and search, which determines whether the transition happens at all. Three results emerge. Effort falls short of the level that maintains human capital, so on the temporary job human capital depreciates. Effort rises unambiguously with its current payoff, and in most configurations of the relevant parameters with the future payoff and patience as well. Pay across the two jobs can move either way, but welfare unambiguously rises, so the depreciation of her human capital, and the possible pay cut in the transition, are the price the worker optimally pays for her chance of a permanent job.

The model owes its simplicity and sharp results to two assumptions. First, the temporary contract here ends with certainty, while in the real world its conversion into a permanent position is the firm's choice and, in many cases, the worker's hope. Modeling conversion would require a firm that decides, and would give the worker a second prize to work for. It is the extension I would pursue first.[13] Second, the worker who lands the permanent job makes no further choices, so the model is

[13] I owe this observation to Cédric Tille.

silent on effort and potential search inside permanent employment and on chains of temporary jobs along the way. Modeling either would extend the choices past the end of the temporary contract, with the worker allocating her time period after period and carrying her human capital across rounds.

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Appendix

A Proof of Proposition 1

Preliminaries Under the functional forms of Section 2, the objective (5) becomes:

$$U(e_1, h_1) = \alpha + \beta e_1 - \frac{h_1^2}{2} + \delta (h_1 - e_1)(\alpha e_1 + \beta) \tag{A1}$$

which is a quadratic form in (e_1, h_1).

Second-order conditions The Hessian of (A1) is:

$$H = \begin{pmatrix} -2\rho & \rho \\ \rho & -1 \end{pmatrix}$$

Its first leading principal minor is $-2\rho < 0$, while its determinant is $\rho(2-\rho)$, which is strictly positive if and only if $\rho < 2$ given $\rho > 0$. Hence, under $\rho < 2$, H is negative definite everywhere, U is globally strictly concave, and the critical point (e_1^*, h_1^*) in (15) and (16) is the unique global maximum. s^* in (17) then follows from (4).

Positivity of e_1^* and h_1^* The numerator of (15) is $\beta[1-\delta(1-\rho)]$. This is strictly positive for any $\delta \in (0,1)$, $\rho > 0$, and $\beta > 0$, as is apparent by rewriting it as $\beta[(1-\delta)+\delta\rho]$. The numerator of (16), $\beta(1+\delta)$, is strictly positive. Both denominators are strictly positive if and only if $\rho < 2$. Hence $\rho < 2$ is necessary and sufficient for $e_1^* > 0$ and $h_1^* > 0$.

Upper bound on hours Given $2-\rho > 0$, multiplying both sides of $h_1^* < 1$ by $2-\rho$ shows that $h_1^* < 1$ if and only if $\beta(1+\delta) < 2-\rho$.

Positivity of search Given $\rho < 2$, the denominator of (17) is strictly positive, so $s^* > 0$ if and only if its numerator is, that is, if and only if $\delta + \rho > 1$. Since $s^* = h_1^* - e_1^*$ by (4), $s^* > 0$ implies $e_1^* < h_1^*$. Optimal effort never exhausts optimal working time.

Combining the above, $0 < e_1^* < h_1^* < 1$. Furthermore, since $f(s) = s$ implies $f^* = s^*$, the job-finding probability satisfies $0 < f^* < h_1^* < 1$ and is therefore admissible. ■

B Proof of Proposition 2

Throughout, derivatives are taken with respect to the primitives β, α, and δ. The quantity $\rho \equiv \delta\alpha$ appears only as shorthand. All expressions are evaluated on the admissible region of Proposition 1.

Part (i) Differentiating (16):

$$\frac{\partial h_1^*}{\partial \beta} = \frac{1+\delta}{2-\rho} > 0 \qquad \frac{\partial h_1^*}{\partial \alpha} = \frac{\beta\delta\,(1+\delta)}{(2-\rho)^2} > 0 \qquad \frac{\partial h_1^*}{\partial \delta} = \frac{\beta\,(2+\alpha)}{(2-\rho)^2} > 0$$

and differentiating (17):

$$\frac{\partial s^*}{\partial \beta} = \frac{\delta+\rho-1}{\rho\,(2-\rho)} > 0$$

$$\frac{\partial s^*}{\partial \alpha} = \frac{\beta\left[(\rho-1+\delta)^2+\left(1-\delta^2\right)\right]}{\alpha^2\delta\,(2-\rho)^2} > 0$$

$$\frac{\partial s^*}{\partial \delta} = \frac{\beta\left[(\rho-1)^2+1+\delta\rho\right]}{\alpha\delta^2\,(2-\rho)^2} > 0$$

where the numerator of the first of these expressions is positive by $\delta+\rho>1$. The numerators of the other two expressions are sums of squares and positive terms.

Part (ii) Differentiating (15) with respect to β:

$$\frac{\partial e_1^*}{\partial \beta} = \frac{1-\delta\,(1-\rho)}{\rho\,(2-\rho)}$$

The numerator is strictly positive, as shown in Appendix A, and the denominator is strictly positive under $\rho<2$.

Part (iii) Differentiating (15) with respect to α:

$$\frac{\partial e_1^*}{\partial \alpha} = \frac{\beta\left[\delta\rho^2-2\,(1-\delta)\,(1-\rho)\right]}{\alpha^2\delta\,(2-\rho)^2}$$

The denominator is strictly positive. The derivative is therefore strictly positive if and only if $\delta\rho^2 > 2(1-\delta)(1-\rho)$.

Part (iv) Differentiating (15) with respect to δ:

$$\frac{\partial e_1^*}{\partial \delta} = \frac{\beta\left[\rho\,(2+\delta)-2\right]}{\alpha\delta^2\,(2-\rho)^2}$$

The denominator is strictly positive, so the derivative is strictly positive if and only if $\rho(2+\delta)>2$.

Part (v) Differentiating σ_s, given in (18), with respect to α and δ:

$$\frac{\partial \sigma_s}{\partial \alpha} = \frac{1-\delta}{\alpha^2 \delta \left(1+\delta\right)} \qquad\qquad \frac{\partial \sigma_s}{\partial \delta} = \frac{1+2\delta-\delta^2-\delta\rho}{\alpha\delta^2 \left(1+\delta\right)^2}$$

The first is a ratio of strictly positive quantities. In the second, the denominator is strictly positive. Under the assumption $\rho < 2$ from Proposition 1, the numerator satisfies $1+2\delta-\delta^2-\delta\rho > 1+2\delta-\delta^2-2\delta = (1+\delta)(1-\delta) > 0$. Hence σ_s is strictly increasing in both α and δ. The statement for σ_e follows from $\sigma_e + \sigma_s = 1$. ■

C Proof of Corollary 1

Recall $\tau \equiv \delta\rho^2 - 2(1-\delta)(1-\rho)$ and $\psi \equiv \rho(2+\delta) - 2$, the sign-determining brackets of parts (iii) and (iv) of Proposition 2. Differentiating, $\partial\tau/\partial\rho = 2\delta\rho + 2(1-\delta) > 0$ and $\partial\psi/\partial\rho = 2+\delta > 0$. Moreover, $\tau < 0$ and $\psi < 0$ at $\rho \to 0$, so each expression changes sign exactly once as ρ rises, from negative to positive. Denote the respective roots ρ_τ and ρ_ψ, the latter with the closed form $\rho_\psi = 2/(2+\delta)$. Evaluating τ at ρ_ψ:

$$\tau\Big|_{\rho=\frac{2}{2+\delta}} = \frac{2\delta^2 \left(1+\delta\right)}{\left(2+\delta\right)^2} > 0$$

Since τ is increasing and already positive at ρ_ψ, its root satisfies $\rho_\tau < \rho_\psi$. This establishes the three regimes. For $\rho < \rho_\tau$, both τ and ψ are negative, so $\partial e_1^*/\partial\alpha < 0$ and $\partial e_1^*/\partial\delta < 0$. For $\rho_\tau < \rho < \rho_\psi$, τ is positive while ψ is still negative, so $\partial e_1^*/\partial\alpha > 0$ and $\partial e_1^*/\partial\delta < 0$. For $\rho > \rho_\psi$, both τ and ψ are positive, so $\partial e_1^*/\partial\alpha > 0$ and $\partial e_1^*/\partial\delta > 0$. A configuration with $\partial e_1^*/\partial\alpha < 0$ and $\partial e_1^*/\partial\delta > 0$ cannot arise. It would require $\tau < 0$ and $\psi > 0$, hence $\rho < \rho_\tau$ and $\rho > \rho_\psi$ simultaneously, which contradicts $\rho_\tau < \rho_\psi$.

Finally, at $\rho \geq 1$, both expressions are positive by direct evaluation:

$$\tau = \delta\rho^2 + 2\left(1-\delta\right)\left(\rho-1\right) \geq \delta + 2\left(1-\delta\right)\left(1-1\right) = \delta > 0$$

$$\psi = \rho\left(2+\delta\right) - 2 \geq \left(2+\delta\right) - 2 = \delta > 0$$

Hence $\rho \geq 1$ places the parameters in the regime in which e_1^* is increasing in both α and δ. ■

D The model with k_1 free

This appendix solves the model without the normalization $k_1 = 1$ and shows that it is without loss of generality for every result in the paper. With k_1 free, the wage schedules are $w_1 = k_1(\alpha + \beta e_1)$ and $w_2 = k_1(\alpha e_1 + \beta)$, and the objective becomes:

$$U(e_1, h_1) = k_1(\alpha + \beta e_1) - \frac{h_1^2}{2} + \delta(h_1 - e_1)k_1(\alpha e_1 + \beta) \tag{A2}$$

Solution Define the generalized discounted return to human capital $\widetilde{\rho} \equiv \delta\alpha k_1$, which reduces to the definition in the main text at $k_1 = 1$. The unique solution of (A2) is:

$$e_1^* = k_1 \frac{\beta[1 - \delta(1 - \widetilde{\rho})]}{\widetilde{\rho}(2 - \widetilde{\rho})} \qquad h_1^* = k_1 \frac{\beta(1 + \delta)}{2 - \widetilde{\rho}} \qquad s^* = k_1 \frac{\beta(\delta + \widetilde{\rho} - 1)}{\widetilde{\rho}(2 - \widetilde{\rho})}$$

that is, the solutions of the text evaluated at the generalized $\widetilde{\rho}$ and scaled by k_1.

Second-order and interiority conditions The Hessian of (A2) has determinant $\widetilde{\rho}(2 - \widetilde{\rho})$. The second-order conditions thus again reduce to $\widetilde{\rho} < 2$. Positivity of e_1^* and h_1^* holds under $\widetilde{\rho} < 2$ by the argument of Appendix A. Search (s^*) is positive if and only if $\delta + \widetilde{\rho} > 1$. Hours satisfy $h_1^* < 1$ if and only if $\beta k_1(1 + \delta) < 2 - \widetilde{\rho}$. Thus k_1 enters the conditions of Proposition 1 only inside $\widetilde{\rho}$ and through the product βk_1 in the hours ceiling. For given α, δ, and k_1, e_1^* is proportional to β, and the hours ceiling requires $\beta < (2 - \widetilde{\rho})/[k_1(1 + \delta)]$. At that bound, $e_1^* - 1 = -(\delta + \widetilde{\rho} - 1)/[\widetilde{\rho}(1 + \delta)] < 0$. Hence $e_1^* < 1$, and with it $k_2 = k_1 e_1^* < k_1$, for every admissible β, exactly as in the main text.

Comparative statics and regimes The derivatives of h_1^* and s^* keep the signs of part (i) of Proposition 2, and $\partial e_1^*/\partial\beta = k_1[1 - \delta(1 - \widetilde{\rho})]/[\widetilde{\rho}(2 - \widetilde{\rho})] > 0$ as in part (ii) of that proposition. For the responses of effort to α and δ, differentiating,

$$\frac{\partial e_1^*}{\partial \alpha} = \frac{\beta\left[\delta\widetilde{\rho}^2 - 2(1 - \delta)(1 - \widetilde{\rho})\right]}{\alpha^2\delta(2 - \widetilde{\rho})^2} \qquad \frac{\partial e_1^*}{\partial \delta} = \frac{\beta[\widetilde{\rho}(2 + \delta) - 2]}{\alpha\delta^2(2 - \widetilde{\rho})^2}$$

and, since β and both denominators are positive, the signs are those of the bracketed terms, which are τ and ψ evaluated at $\widetilde{\rho}$. Corollary 1 – the monotonicity of τ and ψ in $\widetilde{\rho}$, the ordering of their roots, the three regimes, and the sufficiency of $\widetilde{\rho} \geq 1$ – follows unchanged, since its proof uses only the functional forms of τ and ψ in $(\widetilde{\rho}, \delta)$.

Shares Dividing e_1^* and s^* by h_1^* yields the shares of the working day, which are the expressions in (18) evaluated at $\widetilde{\rho}$. Hence k_1 affects the composition of the day only through $\widetilde{\rho}$. The monotonicity of part (v) of Proposition 2 also holds. First, $\partial\sigma_s/\partial\alpha = (1-\delta)/[\alpha^2\delta k_1(1+\delta)] > 0$. Second, $\partial\sigma_s/\partial\delta$ has numerator $1 + 2\delta - \delta^2 - \delta\widetilde{\rho} > 1 - \delta^2 > 0$ under $\widetilde{\rho} < 2$.

Wage change and welfare The wage change becomes $\omega = k_1(\alpha - \beta)(e_1^* - 1)$. Hence sign ω = sign$(\beta - \alpha)$, exactly as in the text, and $\partial\omega/\partial\delta$ inherits the sign of $(\alpha - \beta)\psi$, with ψ evaluated at $\widetilde{\rho}$. The welfare derivatives are those of (20) scaled by k_1: $\partial U^*/\partial\beta = k_1(e_1^* + \delta s^*)$, $\partial U^*/\partial\alpha = k_1(1 + \delta e_1^* s^*)$, and $\partial U^*/\partial\delta = s^* k_1(\alpha e_1^* + \beta)$, all strictly positive.

Summary Initial human capital enters the solution in two ways. It scales the levels of effort, hours, and search, and it enters every condition of the analysis only through the products $\widetilde{\rho} \equiv \delta\alpha k_1$ and, in the hours ceiling, βk_1. No sign, threshold, regime, share, or welfare conclusion is affected. Every result in the paper holds unchanged once ρ is read as $\widetilde{\rho}$. ■