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Summary

This paper formalizes the use of flexible labor contracts in an efficiency wage framework and derives market dualism as an endogenous outcome. By allowing temporary contracts to be either renewed or converted into permanent contracts, new theoretical insights emerge both on the equilibrium wage structure and the incentive problem faced by workers and firms. Since temporary workers weigh the outside option of entering the labor market through permanent positions, the rate at which fixed-term contracts are converted into open-ended contracts is itself an incentive device which acts as a substitute for the wage. It follows that, even if temporary workers face a higher job loss risk, firms pay a wage differential in favor of permanent workers. The model also predicts that in equilibrium firms hire exclusively under flexible contracts, then half of them is converted into stable contracts while the remaining contracts are left to expire. Thus, in steady state, firms let permanent positions to survive in order to sustain the wage incentive structure.

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WAGE INCENTIVE PROFILES

IN DUAL LABOR MARKETS[*]

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Abstract

This paper formalizes the use of flexible labor contracts in an efficiency wage framework and derives market dualism as an endogenous outcome. By allowing temporary contracts to be either renewed or converted into permanent contracts, new theoretical insights emerge both on the equilibrium wage structure and the incentive problem faced by workers and firms. Since temporary workers weigh the outside option of entering the labor market through permanent positions, the rate at which fixed-term contracts are converted into open-ended contracts is itself an incentive device which acts as a substitute for the wage. It follows that, even if temporary workers face a higher job loss risk, firms pay a wage differential in favor of permanent workers. The model also predicts that in equilibrium firms hire exclusively under flexible contracts, then half of them is converted into stable contracts while the remaining contracts are left to expire. Thus,

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Keywords: Dual labor market, efficiency wages, wage differentials, flexible contracts.

JEL Classification Numbers: J31, J41, J63.

1   Introduction

Since the mid eighties, European labor markets have been deeply shaped by the spread of fixed-term (also known as short-term or flexible) labor contracts. Moreover, political obstacles to reducing the employment protection coverage for already protected workers have constrained legislators to implement reforms at the margin, leading to dualism in the labor market[1].

While researchers have thoroughly investigated the impact of flexible contracts on unemployment (Bentolila and Bertola, 1990), job turnover and wages (Kugler, 1999, 2005), firms' propensity to grow (Schivardi and Torrini, 2008), productivity growth (Bassanini et al., 2008) and firms' recruiting policies (Kahn, 2007), this paper has two main goals. First, we develop a model featuring dualism in the labor market as an endogenous outcome sustained by efficiency wage considerations in the spirit of Shapiro and Stiglitz (1984). Second, our paper puts forward a possible explanation of the negative wage differential experienced by temporary workers with respect to permanent ones, even if it should be reasonable to reward a higher job loss risk through higher wages.

Both the existence of a wage differential between temporary and permanent workers and the survival in the market of both types of contract have been reported for many European

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[1]The concept of *dual* labor market (also two-tier labor market) was originally set forth in the work of Doeringer and Piore (1971) in the attempt to describe a labor market made up of a primary and a secondary sector. Compared to jobs in the secondary sector, those in the primary sector generally have a higher pay, better job security, stability and working conditions, more training and career opportunities.

Countries. Jimeno and Toharia (1993) find a 9-11% wage gap for the Spanish experience. Blanchard and Landier (2002) conclude that the wage gap in France has risen from 12% in 1983 to 22.5% in 2000. Hagen (2002) comes to similar conclusions for Germany, even if different methodologies lead to sizable differences in the magnitude of the wage penalty suffered by temporary workers.

Our theoretical argument starts from the way workers value fixed-term positions and results in the coexistence of contract types in the labor market equilibrium. The model formalizes the use of temporary contracts in an efficiency wage framework in which profit maximizer firms optimally set the share of temporary workers to satisfy participation and incentive compatible constraints. We allow temporary contracts to be either renewed or converted into permanent contracts to take into account multiple spells of unemployment and temporary positions. Also, we endogenously determine optimal conversion and renewal rates without relying on exogenous labor market institutional features. In this way, the incentive problem changes dramatically, and so does the equilibrium wage structure.

This paper argues that the ratio of temporary to permanent workers is linked to the incentive structure arising in a dual labor market. When firms increase their temporary workforce, the ratio of temporary contracts over permanent ones cannot exceed a given threshold because it would be impossible to provide sufficient incentives to avoid workers' opportunistic behavior. It follows that, when employers can renew fixed-term positions, convert them into permanent ones or leave them to expire, the coexistence of both contracts is necessary to ensure a steady state mass of non-shirking workers who are paid accordingly. We also show the way in which the rate at which temporary jobs are converted into permanent ones affects the wage differential.

Dual labor market theories have been developed in the attempt to explain why workers, even if equally productive, are allocated in a primary or a secondary sector of the economy and receive different wages. Although many models predict that wages should be increasing

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in the job loss risk, in contemporary labor markets, temporary workers are paid, on average, less than their permanent counterparts even if they face greater uncertainty about their future employment status[2]. With the aim of explaining inter-industry and inter-occupation wage differentials, Bulow and Summers (1986) elaborate a formal framework to analyze dualism in the labor market. In their model, dualism is assumed rather than derived and jobs fall into either the primary or the secondary sector because of technological duality. Assuming that only the primary sector jobs must be monitored, the wage in that sector must be high enough to induce workers not to shirk, while in the secondary sector workers are paid the value of the marginal product of labor. In equilibrium there will be a wage differential between workers of different sectors that cannot be absorbed by market forces. Subsequently, even in the absence of variation in monitoring technology across firms, Rebitzer and Taylor (1991) have shown that dual labor markets may also arise as a consequence of product demand uncertainty. Moreover, even if workers are homogeneous and perfect substitutes in production, a single profit-maximizing firm may find it optimal to simultaneously offer both secondary and primary jobs. Differently, Albrecht and Vroman (1992) endogenize the persistence of "good jobs" and "bad jobs" by assuming both non-convexity in the monitoring technology and worker heterogeneity on the value placed on leisure. We stress the fact that in our model dualism does not depend on sectorial, firm or worker heterogeneity, but is simply triggered by the way workers put value on the potential gain or loss of opportunistic behaviors.

More recently, some authors have tried to derive dualism in a search and matching framework. Berton and Garibaldi (2012) suggest that the equilibrium ratio of temporary to permanent contracts can be driven by the trade-off faced by firms between an ex-ante slower job filling rate and an ex-post more flexible dismissal rate[3]. Differently, Wasmer (2001) points

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[2]One would expect wage compensating differentials to work for jobs with higher unemployment risk in order to become sufficiently attractive (Rosen, 1986). However, empirical research has shown that even after controlling for personal and firm characteristics, the wage differential between permanent and temporary workers does not vanish (Booth et al. 2002 and Hagen, 2002).

[3]Nevertheless, in their model, wages for permanent and temporary jobs are assumed to be equal, meaning that price movements, and their allocative effects, are ruled out.

out that the coexistence of long- and short-term contracts depends on an arbitrage between endogenous turnover costs and the expected profit depending on the duration of the job. Their results derive from a variant of the capitalization effect of growth discussed in Aghion and Howitt (1994), which increases the tightness of labour markets and, therefore, induces firms to retain workers by offering them long-term contracts.

To sum up, without relying on differences in the hiring and firing costs or other institutional features of the market, this paper contributes to the strand of the literature aimed at describing the conditions under which fixed-term and open-ended contracts coexist as an equilibrium in which equally skilled and productive workers are paid different wages.

Moreover, the model yields three corollary results. First, dualism is both a market and a firm feature. Even if workers are perfect substitutes in production, a single firm finds it optimal to employ both types of contract, and market dualism is, thus, a consequence of the internal dualism. Second, there will be rationing[4] also for those who are already employed as fixed-term workers. While they would prefer a permanent contract, firms limit the number of permanent contracts to a given threshold in order to keep lower the overall wage bill. Since the adjustment of internal workforce composition does not alter the level of unemployment, the incentives not to shirk are still effective. Third, in line with the observed evidence that the majority of newly hired workers enter the labor market through fixed-term positions[5], given the steady state fraction of flexible workforce set by firms, entrants in the labor market are always offered flexible contracts.

The remainder of the paper is organized as follows. Section 2 presents the model. We start formalizing the use of temporary contracts in an efficiency wage framework. Then, we derive the no-shirking conditions and solve the problem faced by firms about the optimal

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[4]As in the standard model of efficiency wages, unemployment is involuntary. Indeed, at the ongoing wage structure, workers are willing to accept a job but, given the negative relationship between wages and unemployment, firms know that unemployment would not serve anymore as an effective discipline device, because one more hiring would lower effort and productivity of workers.

[5]See, among others, Bentolila and Saint-Paul (1992), Cahuc and Postel-Vinay (2002) and Goux et al. (2001).

renewal and conversion rates. Finally, we focus on the steady state conditions to characterize the labor market equilibrium. Section 3 discusses some final remarks and concludes.

2 The Model

2.1 Structure and contractual relationships

The model is set in continuous time. The economy is populated by H infinitely-lived risk neutral workers identical in their abilities, skills and preferences. There are N perfectly competitive firms and labor is the only input for production. Profit-maximizer firms face inelastic supply of labor and employ all the labor they want. Workers aim at maximizing the expected present value of their lifetime utility. Workers and firms discount at the common rate δ.

An employer-employee relationship can be regulated either by a permanent contract (p) or a fixed-term one (t). The latter lasts for one period and, at the expiration, it can be converted into a permanent contract with probability c_p, renewed as a temporary position with probability c_t or left to expire with probability $1 - c_p - c_t$[6]. Through this structure, the model is able to simulate a work-life pattern in which workers may reach a stable job after a succession of short-term jobs and unemployment spells.

At a given moment in time, workers can either be employed or unemployed. If unemployed, workers are available for employment opportunities and do not receive unemployment benefits. Instead, employed workers enjoy an instantaneous utility which is a function of wages and effort, $U(w_i, e) = w_i - e$, where w_i is the wage received while holding the $i - th$ contract $(i = \{p, t\})$ and e is the effort. The level of effort can take only two values, positive and constant (no-shirking) or null (shirking). In the latter case there is no production. Since

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[6]The rates of contract renewal and conversion are endogenously set by firms, however they must be thought of as given from the workers' point of view.

all workers are identical, they behave in the same way and whether or not they shirk depends on the incentives they face. If workers decide to shirk, the effort is null and they gain higher levels of utility while facing a probability b (which is exogenously given) of being caught shirking and then being fired. It follows that, on average, shirkers tend to spend more time as unemployed. In addition, while permanent jobs disappear at the exogenous rate q, temporary workers become unemployed as a direct consequence of the endogenous choice of firms about renewal and conversion rates[7]. Although non-shirker workers enjoy lower levels of utility with respect to shirkers, given that effort is costly, they have better expectations about their job stability.

Finally, unemployed workers can enter the labor market by receiving a job offer for a permanent contract at the rate a_p or a temporary contract at the rate a_t. Since firms choose workers at random out of the pool of unemployed workers, the probability of finding a job is affected by the rate of job breakups, the level of unemployment and the stock of employed workers. Whether the employer-employee relationship is regulated by a fixed-term contract or a permanent one depends on firms' choice about the optimal workforce composition[8]. Therefore, defining $0 \leq f \leq 1$ as the fraction of temporary workers per firm, both arrival rates turn out to depend also on the workforce composition[9].

Given the structure of the economy, firms and workers interact as follows. First, each profit-maximizer firm chooses the optimal fraction of temporary workers (f); second, it sets the labor force it requires (L); third, it offers the wage w_i ($i = \{p,t\}$) consistent with the specific contract. These wages are efficiency wages which minimize labor costs per efficiency unit. Since a job opportunity provides almost the utility of an unemployment position, workers will accept opportunities that arise and choose the effort level.

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[7]While the assumption that temporary jobs do not disappear at an exogenous rate makes our results comparable to the standard model of efficiency wages, it does not alter our results.

[8]Note that, we are not ruling out the possibility that each firm chooses to keep its entire workforce under temporary contracts rather than permanent ones.

[9]As before, a_p, a_t and f must be thought of as given from the workers' point of you.

2.2 Asset Values and No-Shirking Conditions

In this section, first we briefly characterize the well-known effort decision problem faced by permanent workers. Then, we formalize the case of temporary workers.

As in Shapiro and Stiglitz (1984), imperfect monitoring implies different asset values according to the option of being, respectively, a non-shirker or a shirker. Let V_p^n and V_p^s be, respectively, the present discounted value of lifetime utility for a non-shirker and a shirker holding a permanent contract. In continuous time, regular dynamics asserts that the asset value equals the wage plus the expected gain (or loss) related to changes in the employment status. Thus:

$$\delta V_p^n = (w_p - e) - q(V_p^n - V_u) \tag{1}$$

and

$$\delta V_p^s = w_p - (q + b)(V_p^s - V_u), \tag{2}$$

where V_u is the value of being unemployed. The usual interpretation holds. Workers will avoid opportunistic behavior only if the expected lifetime utility of being a non-shirker is no smaller than that of being a shirker. Therefore, under permanent contracts, the problem faced by a firm is to set the wage sufficiently high to deter shirking. Thus, when a firm chooses the efficiency wage, w_p, the minimum rent that permanent workers receive is given by the following no-shirking condition:

$$V_p - V_u = \frac{e}{b}. \tag{3}$$

The economics behind this result is that the penalty upon shirking, i.e. the asset loss, should be severe enough so as to deter opportunistic behavior. Since workers are homogeneous and

the value of being unemployed is the same for all workers, there is a unique (lowest) level of wage satisfying equation (3):

$$w_p = e + \delta V_u + \frac{e}{b}(\delta + q). \tag{4}$$

According to the principal-agent paradigm, under permanent contracts, firms use an incentive scheme built on current wages. Differently, as it will become clear in what follows, in the two-tier system, firms will also be able to exploit temporary workers' expectations over contract renewal and conversion.

As for workers with open-ended contract, temporary workers choose whether or not to shirk by comparing the relevant asset values. Specifically, while instantaneous utility is higher for shirkers (w_t) than non-shirkers ($w_t - e$), the expectation of remaining employed is shorter for the former than the latter because of the probability b of being caught shirking. Moreover, fixed-term workers can enjoy either a conversion into a permanent position or a renewal of the temporary contract with probability, respectively, c_p and c_t.

In detail, changes in the employment status produce the following expected gains (or losses). Consider virtuous workers first. When the contract is renewed, even if the asset does not change, workers suffer the loss of opportunity of becoming a permanent worker by receiving a direct offer for a permanent position. We quantify the magnitude of this *outside option* as the value of becoming unemployed and enjoy the unemployed-to-permanent job transition ($V_p - V_u$) conditional on the probability of finding a job from the pool of unemployed (a_p)[10]. Think of a temporary worker, when she receives the news that her contract has been renewed, of course she is happy because she will earn the wage for another period, but at the same time she is also unhappy because she knows that during the same period she cannot get a permanent job offer. In case of conversion, workers enjoy the asset difference between

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[10]As a consequence, we do not explicitly formalize the choice of accepting/rejecting a job offer, rather we rule out that employed workers search on the job.

permanent and temporary positions $(V_p^s - V_t^s)$ weighted by the probability c_p. Finally, in case of firms' inactive behavior, fixed-term employees separate from their jobs with probability $(1 - c_t - c_p)$.

We now consider idler workers behavior. By catching a shirker with probability b, firms fire the worker whose asset loss equals $(V_t - V_u)$. In addition, the worker suffers the loss of the opportunity of a conversion in a permanent contract. Hence, the term $c_p(V_p^s - V_t^s)$ represents the value of the opportunity that shirkers lose when they are caught and fired as a consequence of their opportunistic behavior. Therefore, even if dismissed anyway, the penalty that a worker pays for her misdemeanor is worse than that she had to pay in case of firm's inactive behavior[11].

Summing up, the asset values for non-shirker and shirker workers holding a temporary contract read, respectively, as follows:

$$
\begin{aligned}
\delta V_t^n = & \ (w_t - e) + \\
& + \ \{c_t[\underbrace{(V_t^n - V_t^n) \underbrace{-a_p(V_p^n - V_u)}_{outside\ option}}_{renewal}] + \\
& + \ \underbrace{c_p\left(V_p^n - V_t^n\right)}_{conversion} + \\
& - \ \underbrace{(1 - c_t - c_p)\left(V_t^n - V_u\right)}_{firm's\ inactive\ behavior}\}
\end{aligned}
\tag{5}
$$

and

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[11]Our idea that workers put value also on opportunities is close to Akerlof and Katz's (1989) concept about the potential loss due to forfeiture of the trust fund when workers are caught shirking. Their arguments rely on the workers' effort decision which is not only driven by current wage but also by deferred wages, namely the trust fund.

$$\delta V_t^s \; = \; w_t +$$

$$- \; b\{\underbrace{(V_t^s - V_u)}_{asset\ loss} + \underbrace{c_p\left(V_p^s - V_t^s\right)}_{opportunity\ loss}\} + \tag{6}$$

$$+ \; (1-b)\left\{ c_t\left[(V_t^s - V_t^s) - a_p\left(V_p^s - V_u\right)\right] + c_p\left(V_p^s - V_t^s\right) - (1 - c_t - c_p)\left(V_t^s - V_u\right)\right\}.$$

The fixed-term worker chooses to exert effort if the value of not shirking is at least as large as the value of shirking. Thus, the no-shirking condition for temporary workers can be found by equating the previous two equations:

$$(V_t - V_u)c_t - a_p(V_p - V_u)c_t + \left[(V_p - V_u) + (V_p - V_t)\right]c_p = \tfrac{e}{b}. \tag{7}$$

Given that agents exhibit a forward looking behavior, current workers' decision is affected by future opportunities. In other words, workers are interested in future wages, but they know that these are conditional on the probability of being a temporary or a permanent worker in the next period. In more detail, the way firms can provide incentives to workers - the LHS of equation 7 - can be decomposed in three terms. The first two addends tells us that, for a given conversion rate, an increase in the renewal rate has two distinct effects. From the one side, a greater c_t affects positively the incentive profile because of the lower probability of becoming unemployed, i.e. the punishment is less tough. On the other side, the renewal of a temporary contract implies that the worker still receives the wage as a fixed-term worker, but she has to wait the next period to find out whether she will move to a permanent position. Thus, by increasing the value of the outside option of entering the labor market as a permanent worker from the pool of unemployed, a higher c_t also affects negatively the incentive profile. Differently, the last term implies that c_p can act as an incentive device. Furthermore, this

incentive is more effective the greater is the value of permanent contracts with respect to unemployment and temporary positions. Thus, under a fixed-term contract, a worker may accept a lower current wage as long as it is easier to become a permanent worker through a conversion in the next period.

2.3 Wages, Participation Constraints and Optimal Renewal and Conversion Rates

In this section, we proceed to analyze the incentive compatible wage structure arising in the two-tier system when firms optimally set renewal and conversion rates.

Considering the two no-shirking conditions together (equations 3 and 7), the difference between the value of permanent and temporary jobs is:

$$(V_p - V_t) = \frac{e}{b} \frac{(1 - c_p - c_t + c_t a_p)}{(c_p - c_t)}.$$ (8)

By plugging equation 8 in equation 7, we rewrite the no-shirking condition of temporary workers to derive the rent that they enjoy with respect of being unemployed in terms of renewal and conversion rates:

$$(V_t - V_u) = \frac{e}{b} \frac{(2c_p - c_t a_p - 1)}{(c_p - c_t)}.$$ (9)

Equations 3 and 9 must be interpreted not only as the incentive compatible constraints, but also as participation constraints. As such, they are relevant to highlight the difference in the way firms may arrange the terms of contracts when dealing with temporary rather than permanent workers. In detail, the contract offered to permanent workers turns to be attrac-

tive because the condition to avoid shirking also implies that the rent enjoyed by workers is strictly positive. Moreover, since the size of this rent depends exogenously on the effort and the detection technology, it can not be reduced without violating the no-shirking condition. Instead, as far as temporary workers are concerned, firms can modify the size of the rent through the conversion and renewal rates. In this way they are able to deter shirking even by setting a null rent. Specifically, the value of being a non-shirker is no smaller than that of being a shirker also when the value of a temporary contract equals the reservation utility of being unemployed.

By looking at equation 9, figure 1 provides a graphical representation of the space of all the possible combinations of the conversion and renewal rates for which, given a_p, $0 < c_t + c_p \leq 1$[12].

The areas "A" and "B" identify all combinations for which, respectively, $c_p < c_t$ and $c_p > c_t$. In both areas, firms deter shirking by paying a strictly positive premium over the reservation utility (i.e. $V_t - V_u > 0$). Differently, in the area "C", the values of c_t and c_p are such that workers strictly prefer unemployment to temporary positions (i.e. $V_t - V_u < 0$)[13]. Finally, the area "E" represents the set of all the possible combinations of c_t and c_p such that $V_t - V_u = 0$.

Since employers find it optimal not to pay an extra rent over the minimum needed to induce effort, the area "E" identifies the minimum incentive space which is characterized by the following conditions[14]:

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[12]Obviously, when $c_p = c_t = 0$, it would be impossible to avoid shirking.

[13]This area includes the cases for which the renewal and conversion rates are equal ($c_t = c_p \neq 0$) and no finite wages exist to deter shirking.

[14]Another way to derive the solution is to solve for c_t. In this case, it can be shown that the conditions are
$$\begin{cases} c_t = \frac{2c_p - 1}{a_p} \\ \frac{1}{2} \leq c_p \leq \frac{1+a_p}{2+a_p} \end{cases}.$$

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Figure 1: Minimum incentive space
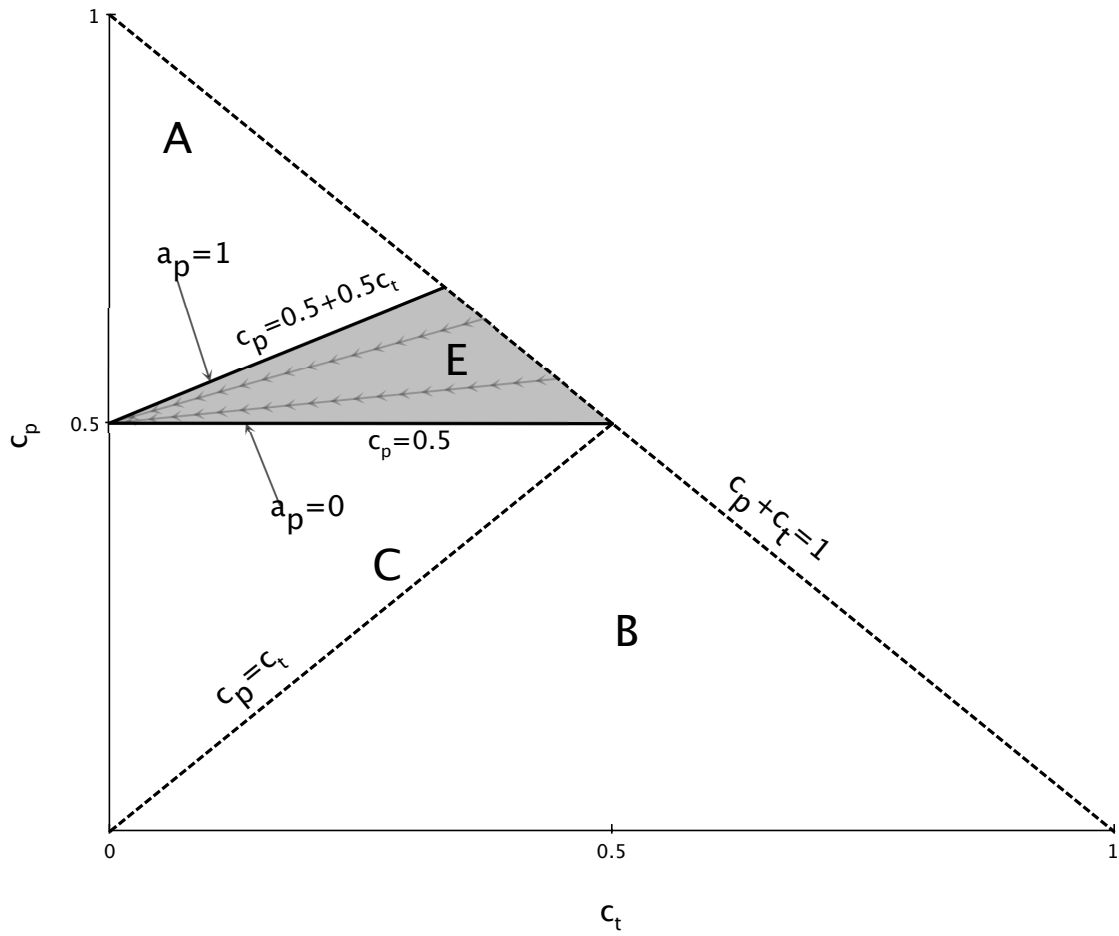
$$\begin{cases} c_p = \frac{1}{2} + \frac{1}{2}c_t a_p \\ 0 \le c_t \le \frac{1-a_p}{2} \end{cases} . \tag{10}$$

In this area, the conversion rate is increasing both in the renewal and the arrival rate of permanent positions. The interpretation is straightforward. Higher values of a_p and c_t increase the asset loss related to the outside option which has to be compensated with a higher expectation of being converted into a permanent contract. Intuitively, the higher is the opportunity to find a permanent job directly from the stock of unemployment, the more the employer has to reward the lower utility. Since the workers' effort decision is driven both by current and future wages, firms may reward the lower utility either by a higher current wage or by a higher probability of a conversion in a permanent position. Thus, it easy to show that the efficiency wage for temporary workers is decreasing in c_p. This means that under fixed-term contract firms can provide substitutable incentives: the higher the conversion rate, the lower the wage paid to temporary workers and vice-versa.

By plugging equations 3, 8, 9 and 10 into 5 and recalling equation 4, the efficiency wages result:

$$\begin{cases} w_p = e + \delta V_u + \frac{e}{b}(q + \delta) \\ w_t = e + \delta V_u + \frac{e}{b}\left(\frac{1}{2}c_t a_p - \frac{1}{2}\right) \end{cases} . \tag{11}$$

Clearly $w_p > w_t$, thus firms can use the conversion and the renewal rates as an optimal strategy to avoid shirking and, simultaneously, minimize the wage bill of temporary workers. Even in the presence of equally productive workers, the existence of dual labor markets implies that firms find it optimal to pay a wage differential in favor of permanent workers. Once the no-shirking conditions are satisfied, an extra unit of money paid to workers would not produce any additional benefit to the firm, but would only result in higher costs. Therefore firms set

the optimal level of c_p and c_t in order to minimize the labor costs. Thus, by looking at the minimum incentive space as defined in 10 and taking into account that w_t is increasing in c_t, the optimal conversion and renewal rates are:

$$\begin{cases} c_p^* = \frac{1}{2} \\ c_t^* = 0 \end{cases} \tag{12}$$

Now we return to the incentive problem by considering the value of being unemployed. As described in section 2.1, unemployed workers can enter the labor market either through permanent or temporary contracts, respectively, at arrival rate a_p and a_t. Therefore, the value of being unemployed reads as follows:

$$\delta V_u = a_p \left(V_p - V_u \right) + a_t \left(V_t - V_u \right), \tag{13}$$

where those who become employed enjoy the asset change by moving away from the unemployed stock.

Since temporary workers are paid the reservation utility, it is easy to write an explicit solution for the wage incentive structure:

$$\begin{cases} w_p = e + \frac{e}{b}(\delta + q + a_p) \\ w_t = e + \frac{e}{b}(a_p - c_p^*) \end{cases} \tag{14}$$

Equations in 14 state that the wages needed to elicit effort are increasing both in the level of effort and in the arrival rate a_p and, are decreasing in the probability to detect shirking. In particular, both the exogenous separation rate and the discount rate positively affect only the wage of permanent workers. Also, two implications are worth noticing. First, equations in 14 imply the existence of a wage differential increasing in the rate of conversion of temporary positions. This result adds to the existing literature a novel rational to the existence of wage

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inequality by arguing that it is a direct consequence of firms' recruiting policies. Second, since temporary workers weigh the outside option of entering the labor market through permanent positions and given the negative sign of c_p^*, the rate at which fixed-term contracts are converted into open-ended contracts is itself an incentive device which acts as a substitute for the wage.

2.4 Equilibrium flows and endogenous arrival rates

In the original model, the economy reaches its steady state when the flows into and out the unemployment stock balance to each other. However, in our model, this steady state condition is not sufficient to identify the rates at which unemployed workers find jobs under fixed-term or open-ended contracts. It is thus convenient to consider separately the stocks of permanent and temporary workers. In this way, we are able to disentangle the effect of the conversion rate on the arrival rates. In more detail, workers who experience a conversion are, simultaneously, an inflow in the stock of permanent workers and an outflow from the stock of temporary workers.

Given the number of firms (N) and the fraction of temporary workers (f), we proceed to define the flows of the relevant stocks. Let consider the stock of permanent workers first. Workers enter this stock either from the pool of unemployed ($H - NL$) - when they receive a permanent job offer at rate a_p - or from the stock of temporary workers (NLf) - when they experience a conversion at rate c_p^*. Movements out of this stock are given by permanent workers ($NL(1 - f)$) who become unemployed at the exogenous separation rate q. Differently, the stock of temporary workers accrues at the rate a_t because of the hirings from the unemployment pool and shrinks at the rate $(1 - c_t^* - c_p^*)$ because of firm's inactive behavior. Thus, the equilibrium flows are:

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$$\begin{cases} a_p(H-NL)+NLfc_p^* = NL(1-f)q & flow\ of\ permanent\ workers \\ a_t(H-NL) = NLf\left(c_p^* + \left(1-c_t^* - c_p^*\right)\right) & flow\ of\ temporary\ workers \end{cases} \tag{15}$$

As a consequence, the endogenous arrival rates results:

$$\begin{cases} a_p = \frac{NL}{(H-NL)}\left(q(1-f)-\frac{1}{2}f\right) \\ a_t = \frac{NL}{(H-NL)}f \end{cases} \tag{16}$$

Clearly, when the market collapses to the one-tier system and no temporary positions are available (i.e. $f = 0$), the rate at which firms hire workers is the same as in Shapiro and Stiglitz (1984). It is easy to check that while a_p is decreasing in f, a_t is increasing and that, since the arrival rates increase with respect to aggregate employment, the efficiency wages in equations 14 are increasing functions of the level of employment.

Finally, it is worth noting that the rates crucially depend on the fraction of flexible labor in the economy (f). Also, for the rates to be interpretable as *arrival* rates ($a_p, a_t \geq 0$), f must lie in the following range:

$$0 \leq f \leq \frac{2q}{2q+1}. \tag{17}$$

2.5   Labor market equilibrium

Once the wage incentive structure and the endogenous arrival rates are known, we close the model by looking at the labor market equilibrium.

The N perfectly competitive firms share the same technology and each of them seeks to maximize profits. The firm's problem is to choose the composition of its labor force in terms

of temporary and permanent workers (i.e. the optimal fraction of temporary contracts) and to set the labor force it requires (L).

We assume a well-behaved production function $F(eL)$ (with $F'(\bullet) > 0$ and $F''(\bullet) < 0$) and, since the firm's decisions at each point in time do not affect future profits, it is sufficient to consider instantaneous total profits, as described by:

$$\Pi = F(eL) - (1-f)Lw_p - fLw_t. \tag{18}$$

Given the perfect substitutability of labor services[15], firms can produce each level of output by employing workers either under permanent contracts, temporary contracts or a combination of both. Since each type of contract is paid differently, the cost of each efficient unit of labor (w) is a linear combination of the efficiency wages weighted by f (i.e. $w = (1-f)w_p + fw_t$). Then, finding the optimal amount of the labor force requires combining the wages in order to find what can be referred as the overall marginal cost curve. Substituting for the endogenous arrival rates of 16 into 14, simple algebra gives us the following aggregate no-shirking condition:

$$w = e + \frac{e}{b}\left(\delta(1-f) + \frac{H}{H-NL}\left(q(1-f) - \frac{1}{2}f\right)\right). \tag{19}$$

Since each firm sets the labor force up to the point where the marginal product equals the overall marginal cost of labor, the equilibrium is given by:

$$eF'(eL) = w. \tag{20}$$

Figure 2 provides a graphical representation of the labor market equilibrium for any value of f. At the point E, workers exert the effort and each firm employs the optimal amount of

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[15]While there are many economic explanations that justify the heterogeneity of productivity, we prefer to consider that permanent and temporary workers are equally productive. In this way, we are confident that our results do not depend upon any over-imposed economic structure.

Figure 2: Labor Market Equilibrium
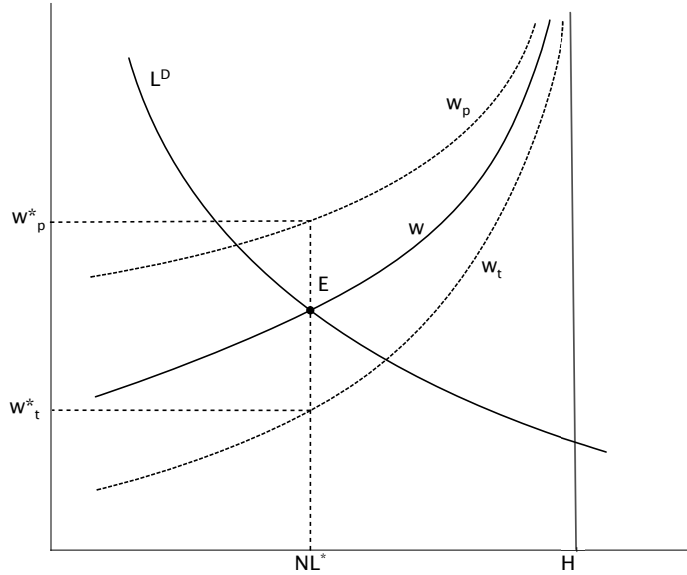
labor (L^*) by paying w_p^* and w_t^*, respectively, to permanent and fixed-term workers.

It is easy to note that an increase of the fraction of fixed-term contract reduces both the efficiency wage of permanent and temporary workers and the overall marginal cost. Intuitively, while in the original model unemployment is the only penalty for being caught and fired, in our model the punishment can be broader interpreted as the utility loss of not having a permanent position. Thus, since a higher f implies a lower stock of permanent workers, the punishment is more effective and it easier to induce workers to be productive. *But to what extent firms can increase f in order to enjoy lower labor costs?* The choice of the optimal fraction of temporary contracts must be sustainable in the long-run equilibrium, thus it needs to be compatible with the incentive structure able to deter shirking. In more detail, for each level of output, the combination of permanent and temporary workers which minimize the production costs is the set of the intersection points between the isocosts and the isoquants.

Figure 3 provides a graphical representation of the problem. Obviously, since permanent workers are paid more than temporary ones, the isocosts are flatter than the isoquants. Thus, the intersection points between each isoquant and the vertical axis show the case in which

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Figure 3: Cost minimization
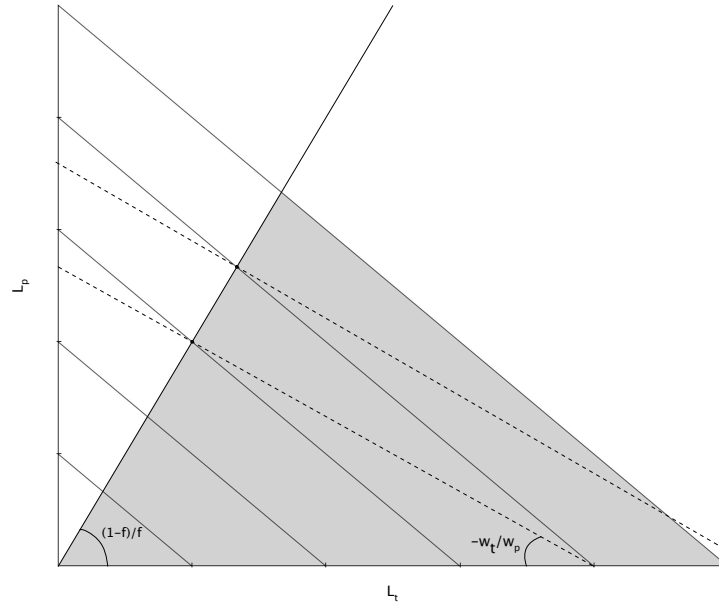
firms use exclusively permanent contracts as in Shapiro-Stiglitz. Differently, the intersection points between each isoquant and the horizontal axis relates to the opposite case in which firms use only temporary workers. We stress the fact that since employees are equally productive under both types of contract and permanent workers are paid more than temporary ones, the higher the value of f, the lower the cost of labor. Moreover, the production expansion path, defined as the ratio between the optimal number of permanent and temporary workers for each level of production, is represented in figure 3 as the increasing line with a slope negatively related to f. Even though firms would always prefer to offer a temporary contract rather than a permanent one, they must also guarantee the equilibrium conversion rate in order to elicit effort[16]. As a result, the incentive structure can be sustained as an equilibrium outcome only if permanent workers do not disappear and temporary workers enjoy a credible expectation to be promoted into a permanent position. Then, each firm will convert half of temporary workers into permanent positions (i.e. $c_p^* = \frac{1}{2}$). Therefore, there exists an equilibrium value of f for which, in steady state, firms maintain the minimum number of

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[16]It means that, in equilibrium, workers' expectations are fulfilled.

permanent contracts and are able to lower the wage bill as much as possible. However, while the area below the line of the production expansion path in figure 3 relates to unfeasible combinations of permanent and temporary workers, the intersection points between each isoquant and the production expansion path show, for each level of output, the evolution of the optimal workforce composition where firms produce at the lowest sustainable cost.

By looking at the aggregate no-shirking condition (equation 19), it easy to check that profits are increasing in f (i.e. $\frac{\partial \Pi}{\partial f} = \frac{e}{b}\left(\delta + \left(q + \frac{1}{2}\right)\frac{H}{H-NL}\right) > 0$) and thus, each firm sets the value of f as higher as possible, but still in the feasible range described in 17. Therefore, the equilibrium value of the fraction of temporary workers results:

$$f^* = \frac{2q}{2q+1}. \tag{21}$$

By plugging f^* into 16, we obtain $a_p = 0$, meaning that each level of production can be achieved at a lower cost by hiring from the stock of unemployed exclusively under fixed-term contracts. It follows that the inflow into the stock of permanent workers is ultimately given by the conversion of temporary contracts. Beyond the equilibrium threshold of f^*, firms would be converting too many fixed-term workers and, consequently, should fire permanent workers to keep unaltered the workforce composition.

3 Conclusions

This paper formalizes a novel source of labor market dualism in an efficiency wage framework where firms have the option to hire workers under flexible or permanent contracts and are able to control the internal mobility toward permanent positions through the conversion of temporary contracts.

By arguing that the conversion rate acts as a substitute for the wage of temporary workers, our analysis sheds light on the nature of the wage differential in favor of permanent workers,

even though it should be reasonable to reward a higher job loss risk through higher wages. However, firms find it optimal to shape their recruiting policies in a way that ensures the survival of open-ended contracts in the long run. Even if firms would tend to substitute permanent workers with temporary ones, the ratio of temporary contracts cannot exceed a given threshold because it would be unfeasible to avoid workers' opportunistic behavior. Indeed, since the incentive scheme offered to fixed-term workers includes the conversion rate as a tool to induce workers to be productive, the tool becomes effective only if workers can actually observe a given fraction of permanent jobs. Then, dualism arises as a feature internal to each firm and, only consequently, as a market property.

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References

Aghion, P. and Howitt, P. (1994). Growth and unemployment. *The Review of Economic Studies*, 61(3):477–494.

Akerlof, G. and Katz, L. (1989). Workers' trust funds and the logic of wage profiles. *The Quarterly Journal of Economics*, 104(3):525–536.

Albrecht, J. W. and Vroman, S. B. (1992). Dual labor markets, efficiency wages, and search. *Journal of Labor Economics*, 10(4):438–461.

Bassanini, A., Nunziata, L., and Venn, D. (2008). Job Protection Legislation and Productivity Growth in OECD Countries. *Economic Policy*, 24(58):349–402.

Bentolila, S. and Bertola, G. (1990). Firing Costs and Labour Demand: How Bad is Eurosclerosis? *Review of Economic Studies*, 57:381–402.

Bentolila, S. and Saint-Paul, G. (1992). The macroeconomic impact of flexible labour contracts: An application to spain. *European Economic Review*, 36.

Berton, F. and Garibaldi, P. (2012). Workers and firms sorting into temporary jobs*. *The Economic Journal*, 122(562):F125–F154.

Blanchard, O. and Landier, A. (2002). The Perverse Effects of Partial Labour Market Reform: Fixed-Term Contracts in France. *The Economic Journal*, 112:F214–F244.

Booth, A., Francesconi, M., and Frank, J. (2002). Temporary Jobs: Stepping Stones or Dead Ends? *Economic Journal*.

Bulow, J. I. and Summers, L. H. (1986). A theory of dual labor markets with application to industrial policy, discrimination, and keynesian unemployment. *Journal of Labor Economics*, 4(3):376–414.

Cahuc, P. and Postel-Vinay, F. (2002). Temporary Jobs, Employment Protection and Labor Market Performance. *Labour Economics*, 9:63–91.

Doeringer, P. B. and Piore, M. J. (1971). *Internal Labor Markets and Manpower Analysis*. Lexington, Mass.

Goux, D., Maurin, E., and Pauchet, M. (2001). Fixed-term contracts and the dynamics of labour demand. *European Economic Review*, 45(3):533–552.

Hagen, T. (2002). Do temporary workers receive risk premiums? assessing the wage effects of fixed–term contracts in west germany by a matching estimator compared with parametric approaches. *Labour*, 16(4):667–705.

Jimeno, J. and Toharia, L. (1993). The effects of fixed-term employment on wages: Theory and evidence from spain. *Investigaciones-Económicas*, 17(3):475–494.

Kahn, L. M. (2007). The impact of employment protection mandates on demographic temporary employment patterns: International microeconomic evidence*. *The Economic Journal*, 117(521):F333–F356.

Kugler, A. D. (1999). The Impact of Firing Costs on Turnover and Unemployment: Evidence from the Colombian Labour Market Reform. *International Tax and Public Finance*, 6:389–410.

Kugler, A. D. (2005). Wage-Shifting Effects of Severance Payments Savings Accounts in Colombia. *Journal of Public Economics*, 89(2-3):487–500.

Rebitzer, J. and Taylor, L. (1991). A model of dual labor markets when product demand is uncertain. *The Quarterly Journal of Economics*, 106(4):1373–1383.

Rosen, S. (1986). *The theory of equalizing differences*, volume 1. Elsevier, Amsterdam.

Schivardi, F. and Torrini, R. (2008). Identifying the effects of firing restrictions through size-contingent differences in regulation. *Labour Economics*, 15(3):482 – 511.

Shapiro, C. and Stiglitz, J. E. (1984). Equilibrium Unemployment as a Worker Discipline Device. *The American Economic Review*, 74(3):433–444.

Wasmer, E. (2001). Competition for jobs in a growing economy and the emergence of dualism. *The Economic Journal*, 109(457):349–371.

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