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ABSTRACT

Temporary Contracts and Monopsony Power in the UK Labour Market*

This paper addresses the applicability of the theory of equalizing differences (Rosen, 1987) in a market in which temporary and permanent workers co-exist. The assumption of perfect competition in the labour market is directly questioned and a model is developed in which the labour market is described as a duopsony and the relation between wage and non-monetary job characteristics is studied for workers with different contract lengths. The empirical analysis, based on several waves of the UK Labour Force Data, confirms several of the hypotheses suggested by the model and emphasizes how in the short run workers who have experienced a change in their employer can expect a career trajectory in line with the theory on compensating differentials. In particular, while the wage dynamic related to workers shifting from a temporary contract to another temporary position cannot be exactly predicted, shifts from temporary to permanent contracts tend to be linked to a reduction in wages and a simultaneous increase in travel-to-work distance. Nonetheless, when unobserved characteristics are accounted for in the selection process into temporary contracts, these results lose significance and only a positive relation between wage and commuting time persists, irrespective of the type of contract.

JEL Classification: J22, J31, J41, J42, L13

Keywords: atypical contracts, oligopsony, compensating differentials, commuting time

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Introduction

The aim of this paper is to examine the relationship between monopsony power and the use of temporary contracts in the UK labour market. The motivation behind this study rests on the simple observation that, *ceteris paribus*, temporary workers seem to face drastically different salaries, working hours, benefits, compared to their permanent colleagues and tend to report lower levels of job satisfaction than permanent workers.[1] This fact is not in line with what suggested by the theory of equalizing differences (Rosen (1987)). If holding a temporary contract is seen as a disadvantage, according to the theory we should observe some wage differentials that compensate for this disamenity. In a more general framework, the lack of compensation for those workers enrolled in undesirable job leads to doubt the possibility to assume that the labour market is perfectly competitive.

Of course, the fact that the labour market cannot be seen as perfectly competitive is not a new finding in economic studies,[2] and several studies already deal with this issue.[3] In recent years, there have been new contributions on the extent of monopsony in the labour market (see Dewit and Leahy (2009), Ransom and Oaxaca (2010) and Staiger, Spetz, and Phibbs (2010)), based on a relatively rich literature that emerged in the 1990s with respect to specific American markets,[4] as for the case of the public school teachers in Missouri (Ransom, Boal, and Beck (2000)), or that of coal mining (as in Boal (1995)). In this paper, the focus is on the labour market as a whole and monopsony power is studied through the investigation of the patterns of wages and commuting time which relate to different kinds of workers. Travel-to-work time is introduced as a proxy for the non-monetary characteristics of a job. This approach is closely linked to the work of Manning (2004), which, starting from the model of Hotelling (1929), develops a theory that explicitly takes monopsony into account by specifying a linear utility function of workers which presents a trade off between wage and commuting time.[5] The main result of Manning is relatively surprising, but

[1] See VV.AA. (2002), pp. 5-6. Evidence on these relationships is also presented in Section 2

[2] The term ‘monopsony’ with respect to the labour market was first used in 1969 by Joan Robinson, see Boal and Ransom (1997), p.86.

[3] One of the most comprehensive studies in this field is certainly Manning (2003). For a shorter review of the literature see also Boal and Ransom (1997) and Bhaskar, A.Manning, and To (2002).

[4] See Ashenfelter, Farber, and Ransom (2010).

[5] Stutzer and Frey (2004) in analysing the loss of utility linked to commuting time in the German market base their estimation of the utility function of the workers on the variable “How satisfied are you with your job”. For a critical analysis of the use of job and life satisfaction variables in economic research see Conti and Pudney (2008). Among the studies on the link between monopsony power and travel-to-work time it is worth citing Falch and Stroem (2006) and Latreille, Blackaby, Murphy, O’Leary, and Sloane (2006). Another example of this literature, related to *urban economics* is given by Brueckner, Thisse, and Zenou (2002).

rich in economic consequences: Commuting is only partially compensated by higher wages. This result strongly questions the validity of theories based on perfect competition in labour markets. In this respect, the main contribution of this paper lies in explicitly accounting for the contractual differences between the temporary and permanent segments of the labour market when testing for the validity of the theory of compensating differentials. The analysis of the link between temporary contracts and monopsony power is performed by developing a simple duopsonistic model in which heterogeneous workers are explicitly differentiated on the basis of the duration of their contracts. The theoretical implications of this approach are then empirically tested making use of a dataset based on several waves of the UK Quarterly Labour Force Survey. The use of UK data is justified because the proportion of temporary workers in the United Kingdom is stable and it is therefore not strongly influenced by the business cycles. Table 1, which shows the percentages of temporary male workers aged 15 to 65 employees in the years 1995-2004, confirms this claim. The characteristics of the UK temporary workers have been effectively studied by Booth, Francesconi, and Frank (2000a) and Booth, Francesconi, and Frank (2002).[6] Their findings depict temporary workers as young, poorly experienced, low-trained employees. Interestingly, temporary workers are generally less satisfied with their jobs than are permanents ones. Furthermore, the bulk of the research reveals that holding a temporary contract can constitute a stepping stone to permanent work, but male workers starting their careers in a fixed-term position tend to experience a relevant wage penalty when they move into a permanent position.[7]

This paper contributes to the literature by explicitly linking the use of temporary contracts to the degree of competition that characterizes the labour market. In the proposed framework firms rely on temporary contracts as a screening device for the ability of the employees without facing the risk to lose the most profitable workers. In fact, as the market is modeled as an oligopsonistic one, workers have limited possibility to search for better contracts in terms of employment stability. Although firms still compete against each other for securing the best workers, they exploit their oligopsonistic power by offering them contractual conditions different from those that would be implied by a perfectly competitive market.

[6]The amount of literature on the use of temporary contracts in the European Labour Markets is extremely relevant. The emergence of a "two tier system" in several European labour markets for example as been studied by Blanchard and Landier (2001), Berton and Garibaldi (2006), Boeri and Garibaldi (2007). In particular, the Spanish case has been heavily studied. See Bentolila and Dolado (1994), Dolado, Garcia-Serrano, and Jimeno (2002), Kugler, Jimeno, and Hernanz (2002), Guell and Petrongolo (2000).

[7]This last result is not found in all the studied markets: see Garcia-Perez and Bullon (2007).

	EU15	UK	Spain	France	Germany	Nether.	Italy
1995	-	6.1	33.3	11.3	9.9	8.5	6
1996	*11.1*	5.9	32.0	11.4	11.0	9.0	6.5
1997	*11.5*	6.3	32.4	12.0	11.5	8.7	6.9
1998	*12.1*	5.8	32.1	12.9	12.1	9.9	7.4
1999	*12.6*	6.0	31.6	13.2	12.8	9.2	8.5
2000	*12.8*	5.7	30.9	14.6	12.5	11.3	8.8
2001	*12.6*	5.8	30.5	13.6	12.2	11.7	8.2
2002	*12.3*	5.3	30.1	12.5	11.8	12.0	8.3
2003	*12.1*	4.9	30.0	11.4	12.2	12.6	7.9
2004	*12.6*	5.0	30.2	11.7	12.7	13.0	9.7

(Source: Eurostat)

Table 1: Percentage of Temporary Workers

The short-run changes in wages and in other job-related characteristics of workers who experience a shift from temporary to permanent employment is the main focus of the analysis proposed in Section 1. In particular, one of the main predictions concerns the occurrence of a simultaneous change in both the employer and the duration of the contract, with the worker switching from a temporary to a permanent position. The suggested theoretical framework leads to the conclusion that this kind of shift is associated with a reduction in the wage and a deterioration of the job characteristics. The empirical analysis conducted in the second part of the paper tends to confirm this conclusion, implying a short-run confirmation of the theory of compensating differentials. Of course this particular career profile only represents one out of a set of possible work trajectories that a temporary worker can experience in a strictly non-competitive labour market. The proposed model allows for a number of alternative profiles, with the analytical results focusing on the short-run features of each. Several of the theoretical implications are confirmed in the empirical analysis. Nonetheless, the existence of a selection bias into temporary contracts can affect the validity of the empirical results, suggesting that unobserved characteristics can have a predominant effect in shaping the career trajectories of non-permanent workers.

The paper is organised as follows. In the next section I outline the theoretical framework employed to describe the career trajectories of temporary and permanent workers. Sections 2 and 3 include a description of the data and the results from the empirical analysis. Section 4 concludes.

1 The Model

The analysis focuses on the first two periods of a potentially infinite horizon. The labour market is a duopoly and can be spatially represented as a mile-long line. There are two identical firms (A and B) in the market, respectively located at each end of the line, so that the distance between the two is equal to 1. In contrast to most of the relevant literature (see, among several others, Hotelling (1929), Bhaskar and To (1999), Bhaskar and To (2003), Bhaskar, A.Manning, and To (2002), Kaas and Madden (2008)[8]) workers are not uniformly distributed along the line; yet, they are pooled in a city (c), located between the two firms. The city is closer to firm A than to firm B. For the moment, this is the only asymmetry between the two firms. Following Manning (2004), I will assume that workers cannot change their residential location.[9] The market is represented in Fig.1.

Workers are characterized by a utility function which depends on the wage and commuting distance. In line with Manning (2003) I hypothesize the following linear relation:

$$U_i(w,d) = w_i^{net} = w_i - \alpha d_i \tag{1}$$

where w_i is the wage of worker i, d_i is the distance between worker i's residential location and the firm and $\alpha \in [0,1]$ measures the cost of commuting. When unemployed, workers have a reservation wage $r = \alpha d_i$. Workers are heterogeneous as each of them is endowed with a certain ability level θ_i. At the beginning of period $t = 0$ the ability of the workers is not perfectly observable. Firms receive a noisy signal of the ability of the workers and rank them on the basis of the expected ability, that is assumed to be uniformly distributed in an interval between $\alpha(1-c)$ and 1.

[8] For a general discussion on Hotelling's model and its extensions, see Tirole (1988), chapters 2 and 7.

[9] See Manning (2004), pag.7. As suggested by the same author, it can be interesting to introduce the possibility of a change in residential location, including some fixed moving costs. Glaeser and Kohlhase (2003) show some evidence on the fragility of such assumption, at least with respect to the American metropolitan regions.

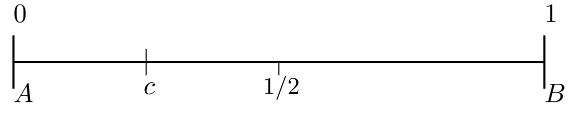

Figure 1: The Market

1.1 The Firms' Strategy in the First Period: Competition or Collusion?

Both firms produce an identical, homogeneous good making use of labour only, according to the following production function:

$$Y_j(\bar{\theta}, L) = \bar{\theta}_j L_j^{\beta}, \quad j = A, B \tag{2}$$

where L_j is the number of workers hired by firm j and $\bar{\theta}_j$ indicates their average ability. The firms' production function is characterized by decreasing returns to scale. The term $\bar{\theta}_j$ operates as a magnifying factor, so that the total level of productivity of the firm directly depends on the ability of its employees.

The firms' strategy is defined by a contract which specifies the wage and the length of the employment period. The duration of the contract can be either infinite, in case of a permanent contract, or equal to one period of time in the case of a temporary one.[10] Given the impossibility for the firms to observe the actual ability of the workers, at the beginning of period 0 all the workers are hired with a temporary contract.[11] Firms can offer a worker a temporary contract only once. If a worker is kept for more than one period he must be offered a permanent contract at the beginning of the second period. A worker employed on a permanent position will change her wage only through to internal bargaining process which takes place within the firm. In particular, I will assume that in every period the wage of worker i will be increased by a factor δt.

The two firms, receiving the same signals, rank the workers in the same way and may compete in order to guarantee themselves the best L individuals. Such a competition process starts with both firms offering workers the wages that make them indifferent between working or remaining unemployed, i.e. $w = \alpha c$ for firm A and $w = \alpha(1 - c)$ for firm B. Nonetheless, each firm has an incentive to deviate from this strategy, offering workers with relatively high expected ability an amount of money above the indifference wage so as to attract them toward itself. The maximum wage the firms can offer will be bounded above by the worker's ability:

$$w_i^j = \theta_i - \alpha d_i \tag{3}$$

with $j = A, B$

[10] For a similar assumption, see Berton and Garibaldi (2006).
[11] This assumption mimics what is suggested by Blanchard and Landier (2001), p. 5.

This competition "á la Bertrand" leads to a unique outcome: Firm A will hire the best L workers.[12] The difference in the commuting time workers have to face can be exploited by firm A in order to systematically offer potential employers a slightly higher wage compared to firm B. Hence, denoting the productivity of the best worker as $\tilde{\theta}$, the maximum wage firm B will be able to offer is:

$$w^B = \tilde{\theta} - \alpha(1-c) \tag{4}$$

and it will always be overcome by firm A's offer:

$$w^A = \tilde{\theta} - \alpha(1-c) + \epsilon \tag{5}$$

with A finding such a strategy profitable as long as: $\epsilon < \alpha(1-2c)$.

If we define as $\underline{\theta}$ the threshold value which indicates the productivity level of the less productive worker among the L hired by A we can rewrite A's and B's profit functions as:

$$\Pi_{0,A}^{Comp} = p\left(\frac{1+\underline{\theta}}{2}\right) L_A^{\beta} - \left(\frac{1+\underline{\theta}}{2} - \alpha(1-c) + \epsilon\right) L_A \tag{6}$$

$$\Pi_{0,B}^{Comp} = p\left(\frac{\underline{\theta}+\alpha(1-c)}{2}\right) L_B^{\beta} - \alpha(1-c) L_B \tag{7}$$

where the difference in the wages paid by the two firms is due to the fact that once firm A has cleared the market from the top workers, firm B is able to hire the "second best" group of workers, by offering them the indifference wage.

The outlined framework illustrates but one of the two options faced by the firms. They can in fact find it profitable to refrain from competing over the best L workers. In particular firm A may decide to opt out of the competition in case the cost in terms of wages overcomes the benefit due to a higher productivity level. If this is the case, both firms will offer the top quality workers a wage equal to the reservation one. Hence, in such a case the profit function of firm A will be:

$$\Pi_{0,A}^{Coll} = p\left(\frac{1+\alpha(1-c)}{2}\right) L_A^{\beta} - \alpha c L_A \tag{8}$$

[12] The described mechanism can only work if the two firms perfectly observe the offers received by the worker. In this respect, see Postel-Vinay and Robin (2002).

in this case perfectly resembling firm B's one:

$$\Pi_{0,B}^{Coll} = p\left(\frac{1+\alpha(1-c)}{2}\right)L_B^{\beta} - \alpha(1-c)L_B \tag{9}$$

Firm B certainly benefits from such a strategy, for $\Pi_{0,B}^{Coll}$ being always larger than $\Pi_{0,B}^{Comp}$ as long as $\underline{\theta} < 1$. On the other hand firm A will always stick to the first option if $\Pi_{0,A}^{Comp} > \Pi_{0,A}^{Coll}$. From the maximization of equation 6, neglecting all the terms involving ϵ, we obtain:

$$L_{0,A}^{Comp} = \left(\frac{F-g}{\beta\ p\ F}\right)^{\frac{1}{\beta-1}} \tag{10}$$

while the optimization value of 8 is:

$$L_{0,A}^{Coll} = \left(\frac{2\alpha c}{\beta\ p\ (1+g)}\right)^{\frac{1}{\beta-1}} \tag{11}$$

where:
$F = \frac{1+\underline{\theta}}{2}$ and $g = \alpha(1-c)$.

Plugging these values into the objective functions we obtain that firm A will decide to compete if the following condition is satisfied:

Condition 1

$$\left(\frac{1+\underline{\theta}}{1+g}\right) > \left(\frac{F-g}{\alpha c}\right)^{\beta} \tag{12}$$

The economic interpretation of the above condition is straightforward. The ratio on the left hand side of the equation can be seen as the benefit the firm gets in terms of productivity from hiring "first best workers" instead of workers which might lie on any point of the ability line. Conversely, the term on the right hand side is the ratio between the marginal cost of hiring the top workers under competition and the marginal cost in case of collusion. Firm A will opt for competition as long as the benefit of such a choice overcomes its cost. Rewriting eq. 12 in a different way, we can define a new function ϕ as the benefit A gets from competition:

$$\phi = \left(\frac{1+\underline{\theta}}{1+g}\right) - \left(\frac{F-g}{\alpha c}\right)^{\beta} \tag{13}$$

From equation 13 we can easily detect that the term raised at the power of β is larger than 1 if

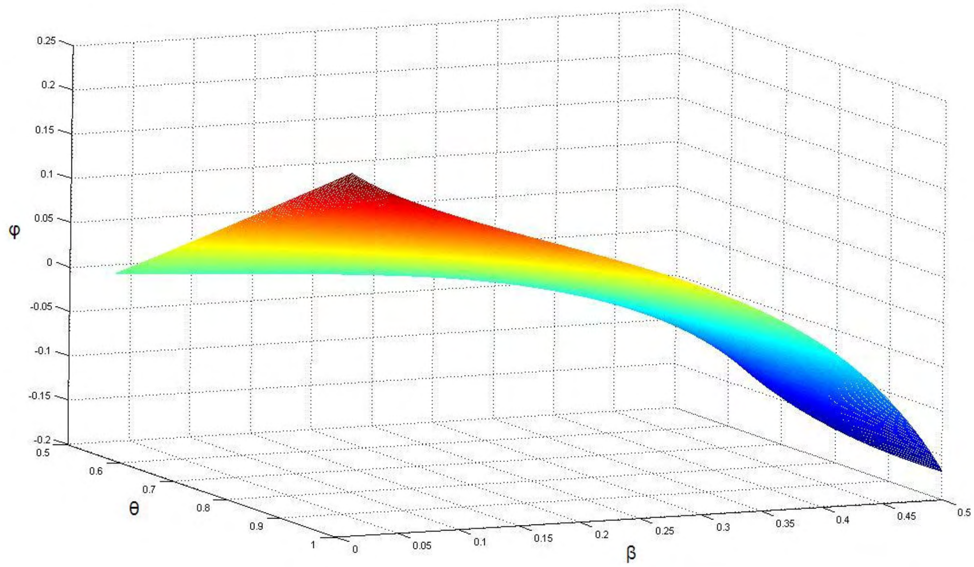

Figure 2: ϕ as β and $\underline{\theta}$ Vary

$F > \alpha$. In this case the function ϕ is monotonically decreasing in β, which implies that a higher marginal productivity of the workers reduces the scope for competition. According to the first derivative of ϕ with respect to θ, the function is increasing in the ability level of the best workers as long as the following condition holds:

$$F > g + \left[\frac{2(\alpha - g)^{\beta}}{\beta(1+g)} \right]^{\frac{1}{\beta-1}}. \tag{14}$$

Hence competition is worthwhile only if the difference in the ability level between the best workers and the others is relatively large. Figure 2 shows the behaviour of ϕ as a function of $\underline{\theta}$ and β.

1.2 Second Period

In this section, it will be assumed that in the first period the firms compete for the best L workers ($\phi > 0$). In this case, we observe that at the end of the first period, firm A hires the best L_A^*

workers at a wage equal to $\left(\frac{1+\theta}{2} - \alpha(1-c)\right)$, while B can hire the "second best" group L_B^* at a wage equal to $\alpha(1-c)$.

In contrast to the previous period, the ability of the workers hired by firm j in period $t=0$ is now perfectly observed by the firm j (but not by the other) and, for some workers, the actual ability level can be different from the expected one. Defining the realized ability level as $\hat{\theta}_i$, this value can only be included within two ranges: $\hat{\theta}_i \in [\underline{\theta}, 1)$ or $\hat{\theta}_i \in (\alpha(1-c), \underline{\theta}]$. This ability is imperfectly observable by the firm not employing the worker, so that for a worker initially employed by firm j, $(j = A,\ B)$, firm k $(k = B,\ A)$ will observe:

$$\tilde{\theta}_{i,\ k} = \lambda_k \times \theta_i + (1-\lambda_k) \times \hat{\theta}_i, \qquad \lambda \in (0,1). \tag{15}$$

The perceived ability can then be seen as a linear combination of the ability perceived in period $t=0$ and the observed ability with weights equal to λ. Given this assumption the changes in the employment possibilities faced by the workers between the two firms in period $t=1$ can now be studied.

1.2.1 Workers' Transition between Firms: From Firm A to Firm B

Once the ability of a worker is perfectly observed, firms can compare his revealed ability with the expected one and decide whether keeping him is profitable. Firm A will keep all the workers whose actual ability level is at least higher than $\underline{\theta}$ and dismiss the others, which can therefore be hired by firm B. Firm B, instead, can potentially keep all its workers (because all workers will reveal an ability higher than $\alpha(1-c)$), but any of its workers with a true ability higher than $\underline{\theta}$ can now be attracted by firm A. The remaining of this section will be devoted to the study of the movements of the workers form one firm to the other.

The analysis initially focuses on firm B. Assume that a share $l_B L_B$ $(0 \leq l \leq 1)$ of workers are revealed as having an ability level $\hat{\theta}_i > \underline{\theta}$. A fraction $(1-\lambda_A)$ of these workers can be hired by firm A, as their perceived ability is higher than the critical threshold $\underline{\theta}$. The remaining $(1-(1-\lambda_A)l_B)L_B$ workers are kept by firm B, under a permanent contract, with a wage $w_{1,B} = \alpha(1-c) + \delta$.

Simultaneously, firm B will (imperfectly) observe the ability of the workers hired by A in period $t=0$. Assuming that a share $l_A L_A$ of these workers reveal a true ability level $\hat{\theta}_i < \underline{\theta}$, firm A will make them redundant. All these workers are now employable by B which, nonetheless, may still presume an ability above the threshold for a share λ_B of them. Given this belief, the best strategy for B consists in offering a proportion $\lambda_B l_A L_A$ of the new workers a permanent contract, in order to prevent them from possibly rejoining firm A in period $t = 2$. For simplicity, I will assume that the wage offered to those workers is going to be identical to the one offered to the other permanent employees, including the tenure premium, δ. It is important to note that for δ "small" firm B has nothing to lose from this strategy: if the actual ability of the worker matches the expected one, B has gained in productivity by having hired a worker whose ability is above $\underline{\theta}$ and therefore above the average ability of B's workers.[13] If the ability is proven to be different from the expected one and below $\underline{\theta}$ (as it should be, given the performance of these workers in firm A), firm B still gains, as it pays the reservation wage to workers whose ability is still above $\alpha(1-c)$. The remaining $(1-\lambda_B)l_A L_A$ workers laid off by A can be hired by B according to the "temporary and then permanent" scheme, guaranteeing them the reservation wage.

B's problem consists now in deciding whether to hire the workers made redundant by A. If B decides not to hire these workers, its profit function in period $t = 1$ can be summarized by the following equation:

$$\Pi_{1,B}^{n} = \begin{array}{c} p\left(\frac{\sum_{i=1}^{L_{0,B}(1-(1-\lambda_A)l_B)}\hat{\theta}_i}{L_{0,B}(1-(1-\lambda_A)l_B)}\right)(L_{0,B}(1-(1-\lambda_A)l_B))^{\beta} + \\ -(\alpha(1-c)+\delta)(L_{0,B}(1-(1-\lambda_A)l_B) \end{array} \tag{16}$$

or, more simply:

$$\Pi_{1,B}^{n} = p\ \Psi X_{0,B}^{\beta} - d\ X_{0,B}. \tag{17}$$

where the term Ψ summarises the average ability of the X workers that remain at B after the first period (i.e., the initial L_B minus the share $(1-\lambda_A)l_B L_B$ which are now hired by A) and d indicates the labour cost.

Conversely, the profit function in case B decides to hire all the workers characterized, by an ability level $\theta_i > \underline{\theta}$ can be written as:

[13] B will not lose from hiring the worker with a permanent contract as long as $\delta < \tilde{\theta} - \alpha(1-c)$. The assumption that the return to seniority is relatively small is not particularly problematic taking into account some of the results empirically obtained in the relevant literature. In particular the reference here is to Altonji and Shakotko (1987) and Altonji and Williams (2005). Nonetheless, for a partly different result see also Topel (1991).

$$
\begin{aligned}
\Pi^h_{1,B} =&\lambda_B \Bigg\{ p \left(\frac{\sum_{i=1}^{L_{0,B}(1-(1-\lambda_A)l_B)} \hat{\theta}_i}{L_{0,B}(1-(1-\lambda_A)l_B)} + \frac{\sum_{i=1}^{l_A L_{0,A}} \theta_i}{l_A L_{0,A}} \right) (L_{0,B}(1-(1-\lambda_A)l_B) + l_A L_{0,A})^\beta + \\
& - (\alpha(1-c)+\delta) \left(L_{0,B}(1-(1-\lambda_A)l_B) + l_A L_{0,A} \right) \Bigg\} + \\
& + (1-\lambda_B) \Bigg\{ p \left(\frac{\sum_{i=1}^{L_{0,B}(1-(1-\lambda_A)l_B)} \hat{\theta}_i}{L_{0,B}(1-(1-\lambda_A)l_B)} + \frac{\sum_{i=1}^{l_A L_{0,A}} \hat{\theta}_i}{l_A L_{0,A}} \right) (L_{0,B}(1-(1-\lambda_A)l_B) + l_A L_{0,A})^\beta + \\
& - (\alpha(1-c)+\delta) \left(L_{0,B}(1-(1-\lambda_A)l_B) \right) - \alpha(1-c) l_A L_{0,A} \Bigg\}
\end{aligned} \tag{18}
$$

or, in a more compact way:

$$
\begin{aligned}
\Pi^h_{1,B} = \lambda_B \left\{ p \, (\Psi_B + \Gamma_B) \, (X_{0,B} + N_{0,A})^\beta - d \, (X_{0,B} + N_{0,A}) \right\} \\
+ (1-\lambda_B) \left\{ p \, (\Psi_B + \Lambda_B) \, (X_{0,B} + N_{0,A})^\beta - d X_{0,B} - \alpha(1-c) N_{0,A} \right\}.
\end{aligned} \tag{19}
$$

where N_A indicates the newly hired workers previously employed by A, whose average ability is equal to Γ for a share λ_B or Λ for a share $(1-\lambda_B)$.

If we summarize the previous equation as:

$$
\Pi^h_{1,B} = \lambda_B Z_1 + (1-\lambda_B) Z_2 \tag{20}
$$

and we compare it with eq. 17, we find that firm B will opt for hiring the $l_A L_{0,A}$ workers coming from firm A as long as the following condition holds:

Condition 2

$$
\lambda_B \geq \frac{\Pi^n_{1,B} - Z_2}{Z_1 - Z_2}. \tag{21}
$$

The general conditions under which the above inequality can be satisfied are reported in Appendix 1. For instance, if δ is small enough (and the difference between the ability level expected in the fist period and that one observed by firm A is large), the term on the RHS of 21 is negative, so that the previous inequality is satisfied and firm B always hires the workers coming from A. On the other hand, it can be proved that for $0 < RHS < 1$ only new temporary workers can be hired with B not incurring in any losses.

1.2.2 From firm B to firm A

In comparison to the situation discussed in the previous paragraph, the potential changes in employment status and employer for the individuals employed by B in $t = 0$ are characterized by slightly different patterns.

At the beginning of period $t = 1$, firm A lays off a share $l_A L_{0,A}$ of the previously hired workers, whose observed ability is below the initial threshold $\underline{\theta}$. Workers whose observed ability is confirmed to be within the interval $\theta \in [\underline{\theta}, 1]$ get a *permanent* contact, enjoying the "tenure premium" δ. A's profit function at the beginning of period $t = 1$ is the following:

$$\Pi_A^n = \begin{array}{c} p \frac{\sum_{i=1}^{L_{0,A}(1-l_A)} \hat{\theta}_i}{L_{0,A}(1-l_A)} (L_{0,A}(1-l_A))^\beta + \\ - \left(\frac{\sum_{i=1}^{L_{0,A}(1-l_A)} \hat{\theta}_i}{L_{0,A}(1-l_A)} - \alpha(1-c) + \delta \right) (L_{0,A}(1-l_A)) \end{array} \tag{22}$$

where the term $\hat{\theta}_i$ indicates the observed ability level of worker i. We can rewrite the above equation as:

$$\Pi_A^n = p\ \Omega_{0,A} X_{0,A}^\beta - (\Omega_{0,A} - \alpha(1-c) + \delta)\, X_{0,A}. \tag{23}$$

Firm A can change this profit function by hiring the share of workers previously employed by B and which have revealed an ability $\hat{\theta} \geq \underline{\theta}$. If worker i reveals an ability $\hat{\theta}_i \geq \underline{\theta}$, firm A will perceive an ability:

$$\tilde{\theta}_i = \lambda_A \times \theta_i + (1 - \lambda_A) \times \hat{\theta}_i. \tag{24}$$

Yet, in contrast to the previous case, if firm A believes that worker i is actually characterized by an ability level equal to the one forecast at $t = 0$ it will refrain from hiring him, so that the profit function will remain the one outlined in equations 22 and 23. The profit function in case A decides to hire the $l_B L_B$ workers can then be expressed as:

$$\Pi_A^h = \begin{array}{c} p\left(\frac{\sum_{i=1}^{L_A(1-l_A)}\hat{\theta}_i}{(1-l_A)L_A} + \frac{\sum_{i=1}^{l_B L_B}\hat{\theta}_i}{l_B L_B}\right)(L_A(1-l_A)+l_B L_B)^\beta + \\ -\left(\frac{\sum_{i=1}^{L_A(1-l_A)}\hat{\theta}_i}{(1-l_A)L_A} - \alpha(1-c)+\delta\right)(L_A(1-l_A)) - \left(\frac{\sum_{i=1}^{l_B L_B}\hat{\theta}_i}{l_B L_B} - \alpha(1-c)\right) l_B L_B \end{array} \tag{25}$$

which I will rewrite as:

$$\Pi_A^h = p(\Omega_{0,A} + \Xi_{0,A})(X_{0,A} + N_{0,B})^\beta - (\Omega_{0,A} - \alpha(1-c) + \delta)X_{0,A} - (\Xi_{0,A} - \alpha(1-c))N_{0,B}. \tag{26}$$

Comparing the above expression with its counterpart for firm B, eq. 19, we note that the wage potentially offered to $l_B L_B$ depends on the ability of these workers. A hires the $N_{0,B}$ workers with a *temporary* contract, in order not to keep them in case they reveal an ability which is actually below the original A's threshold $\underline{\theta}$. Of course such a strategy will be implemented as long as the profit function outlined in eq. 26 overcomes the one presented in eq. 23, i.e as long as $(1-\lambda_A)\Pi_A^h \geq \lambda_A \Pi_A^n$. Rewriting the last condition for λ_A we find that firm A will employ the workers from firm B if and only if:

Condition 3

$$\lambda_A \leq \frac{\Pi_A^h}{\Pi_A^h + \Pi_A^n}. \tag{27}$$

Given $\lambda_A \in [0,1]$, assuming $\Pi_A^h > 0$ and $\Pi_A^n > 0$, the larger the difference between Π_A^h and Π_A^n, the wider the range of values for which the above inequality is satisfied. It is evident that condition 3 would automatically be satisfied in case $\Pi_A^h > 0$, $\Pi_A^n < 0$ and $|\Pi_A^h| > |\Pi_A^n|$. Inverting the previous inequalities would instead lead to a situation in which $RHS < 0$, ruling out any new hiring from A.

Tables 2 and 3 summarize the outcomes of the changes in term of contracts and utility implied by the model. In particular, Table 2 shows that the way each firm perceives the ability of workers initially hired by its competitor is crucial in determining the set of new contracts in period $t = 1$. These perceptions (represented in the model by the probabilities λ_A and λ_B) will determine whether the workers will be offered a new job and, at least with respect to those individuals that will join

	Initial Ability	Ability in t=1	Ability Perceived by A	Ability Perceived by B	Contract in t=0	Contract in t=1
1	$\underline{\theta} \leq \theta_i \leq 1$	$\underline{\theta} \leq \hat{\theta}_i \leq 1$	$\hat{\theta}_i$	irrelevant	Temp. at A	Perm. at A
2	$\underline{\theta} \leq \theta_i \leq 1$	$\alpha(1-c) \leq \hat{\theta}_i \leq \underline{\theta}$	$\hat{\theta}_i$	Prob. λ_B: $\tilde{\theta}_i > \underline{\theta}$	Temp. at A	Perm. at B
3	$\underline{\theta} \leq \theta_i \leq 1$	$\alpha(1-c) \leq \hat{\theta}_i \leq \underline{\theta}$	$\hat{\theta}_i$	Prob $(1-\lambda_B)$: $\alpha(1-c) \leq \tilde{\theta}_i \leq \underline{\theta}$	Temp. at A	Temp. at B
4	$\alpha(1-c) \leq \theta_i \leq \underline{\theta}$	$\alpha(1-c) \leq \hat{\theta}_i \leq \underline{\theta}$	irrelevant	$\hat{\theta}_i$	Temp. at B	Perm. at B
5	$\alpha(1-c) \leq \theta_i \leq \underline{\theta}$	$\underline{\theta} \leq \hat{\theta}_i \leq 1$	Prob. λ_A: $\tilde{\theta} \leq \underline{\theta}$	$\hat{\theta}_i$	Temp. at B	Perm. at B
6	$\alpha(1-c) \leq \theta_i \leq \underline{\theta}$	$\underline{\theta} \leq \hat{\theta}_i \leq 1$	Prob. $(1-\lambda_A)$: $\tilde{\theta} \geq \underline{\theta}$	$\hat{\theta}_i$	Temp. at B	Temp. at A

Table 2: Changes of Contract from t=0 to t=1

firm B in the second period, whether the new contract will be on a temporary or a permanent basis.

Workers experiencing a change in their employment status observe a change in their wages and commuting times. Taking into account the analysis of these elements outlined in the previous paragraphs and the utility function presented in equation 1 we can summarise these changes in terms of modifications of the utility of the workers. Table 3 illustrate these results. Evidently, workers moving from B to A experience a positive change in their utility, since their wage will be related to their ability and shift above the reservation one, while their commuting time will be reduced. A worker hired by B at time $t = 0$ only moves to A if the premium he gets in terms of the ability related wage overcomes the loss of the permanent premium i.e., if $\tilde{\theta}_i - 2\alpha(1-c) \geq \delta$. Conversely, those moving from A to B are subject to a negative change (by construction it must be true that $\alpha \leq \theta_i$). This last change, as we have seen, can be associated to a simultaneous shift from a temporary to a permanent position. The model suggests that this trajectory is associated with a cost: the worker enters the new career with a permanent job but has to face a reduced wage and a higher travel-to-work time. Section 3 is devoted to the empirical analysis of the effects on workers' career profile of the changes in wages and commuting time outlined in Table 3.

	Initial Contract	Final Contract	Initial Wage	Final Wage	Total Change	Net Effect
1	Temp. at A	Perm. at A	$\theta_i - \alpha(1-c)$	$\hat{\theta}_i - \alpha(1-c) + \delta$	$\hat{\theta}_i - \theta_i + \delta$	Unknown
2	Temp. at A	Temp. at B	$\theta_i - \alpha(1-c)$	$\alpha(1-c)$	$2\alpha(1-c) - \theta_i$	Negative
3	Temp. at A	Perm. at B	$\theta_i - \alpha(1-c)$	$\alpha(1-c) + \delta$	$2\alpha(1-c) - \theta_i + \delta$	Negative
4	Temp. at B	Perm. at B	$\alpha(1-c)$	$\alpha(1-c) + \delta$	δ	Positive
5	Temp. at B	Temp. at A	$\alpha(1-c)$	$\tilde{\theta}_i - \alpha(1-c)$	$\tilde{\theta}_i - 2\alpha(1-c)$	Positive

Table 3: Changes in the Utility Function

2 The Dataset and Some Basic Facts

The dataset I use for analysing the predictions of the model is based on the UK Labour Force Survey and covers an eleven-year period, from 1994 to 2004. The Labour Force Survey (LFS) is a quarterly sample survey of households living in the United Kingdom. Every individual in the sample is generally interviewed for 5 quarters in a row before leaving the sample. It is possible to identify individuals across different quarters[14]. All the data employed in the present analysis refer to the September-November quarters. In those surveys the standard variables describing workers' socio-demographic characteristics (such as age, sex, education, type of employment and so on) are complemented with other sets of information of particular interest for our purposes, as, for example, the variables which refer to commuting time. In this paper I focus on individuals in their first and fifth quarters, so that every respondent (and every variable referring to him) is observed twice, with a one-year lag between the first and the second interview. The resulting dataset includes 36,801 male workers, aged from 16 to 65 years, with an average of 3,700 individuals per year. As it is observed that for women temporary contracts are very often offered in combination with part-time arrangements, typically established to better fit the career plans of working mothers, females workers are not included in the sample in order to avoid over-representing part-time workers. The total percentage of temporary workers is 5.48, corresponding to 2,017 workers. This figure includes five different kinds of workers: (1) seasonal workers, (2) people under contract for a fixed period,

[14] Detailed information about the UK Labour Force Survey can be found in the web sites: http://www.statistics.gov.uk/ and http://www.data-archive.ac.uk/.

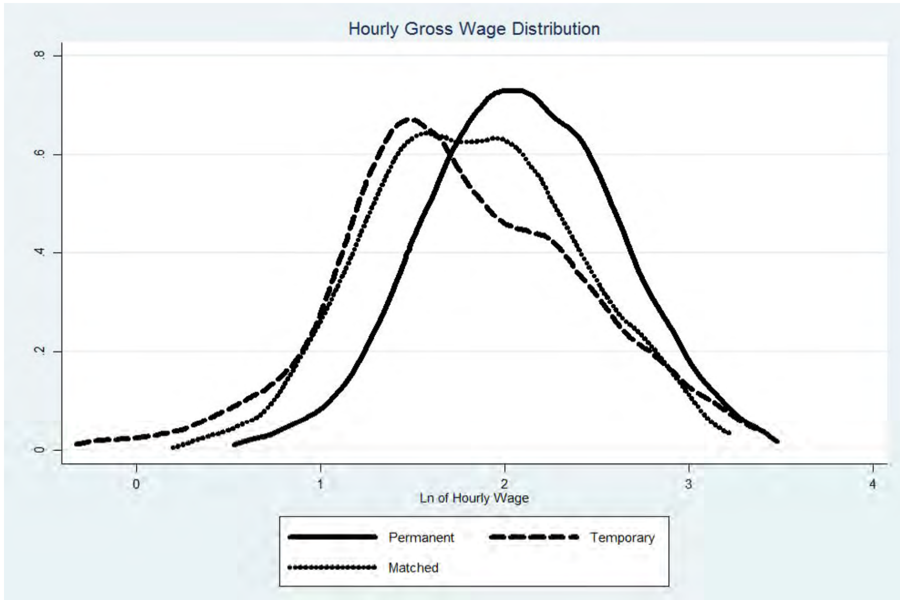

Figure 3: Hourly Gross Wage

(3) workers on agency temping, (4) workers employed in a casual type of work in the reference week and (5) any other not permanent employee. In all the years under analysis, workers under contract for a fixed period account for half of the temporary share, with casual work being the second most common kind of employment (around 20% of temporary workers belong to this category). Table 4 summarizes most of the relevant information on the personal characteristics of the individuals included in the sample.

These figures suggest a definition of temporary workers in line with the relevant literature in terms of age, education and job characteristics and we can observe that the average wage of temporary workers significantly differs from that of the permanent ones. In order to isolate the pure effect on hourly wages of holding a different type of contract a propensity score matching procedure has been implemented, according to relying on a nearest-neighbour matching method and basing the estimation on a set variables that summarise both individual and job characteristics (Leuven and Sianesi (2003)).[15] The result of this analysis is shown in Fig. 3.

It can been seen that the wage distribution (dotted line) of temporary workers significantly

[15] In particular the employed variables are: age, race, marital status, number of children, education level, managerial status, union membership, firm size, sector and region of work, full-time or part-time status. For a theoretical discussion on propensity score matching see Caliendo and Kopeinig (2008) and Caliendo and Hujer (2006). An introduction to propensity score estimators with continuous variables can be found in Angrist and Krueger (1999), pp. 1319-1320.

Sample Composition 1994-2004		
	Permanent	**Temporary**
Number of Observations	34734 (*94.52%*)	2017 (*5.48%*)
Commuting Time	27.19 *24.54*	29.94 *39.43*
Log of Gross Hourly Wage	2.08 *0.597*	1.74 *0.739*
Age Groups		
15-25	12.23	34.04
25-35	21.79	16.55
35-45	22.72	15.91
45-55	24.61	17.72
55-65	13.65	15.78
Pers. Character.		
White	95.21	91.80
Not Married	35.63	55.88
Education		
Univ. Degree	15.30	17.39
High Educ.	11.38	11.02
A-level	7.48	9.90
O-level	28.19	32.73
Basic Educ.	27.14	19.71
No Educ	10.51	9.25
Work Characteristics		
Part-Time	6.54	32.61
Union Memb.	34.35	19.14
Firm Size		
1-10	15.50	15.53
11-19	8.03	6.07
20-24	5.30	6.03
more than 25	71.16	72.37

(Source: LFS, 1994-2004, std. dev. in italics)
The commuting time is calculated on the base of the following question:
"How long in total does it usually take you to travel from home to work?"

Table 4: Sample Descriptive Statistics

differs from that of the permanent ones. This result is two-folded. On the one hand, it is in line with most of the relevant literature on the economics of temporary contracts; on the other, it leads one to question the degree of competitiveness of the labour market and the opportunity to rely on the theory of equalizing differences, at least with respect to the relation between wages and contract duration.

Regarding the link between wages and commuting time, a few aspects are worth noting from the analysis of Table 4 and Figure 3:

1. On average commuting time is shorter for permanent workers than for temporary ones. The average for permanents is: 27.19 minutes per day, while for temporaries is 29.94. The difference is statistically significant at the 95% level of confidence;
2. The difference between the average wages of temporary workers and permanent ones is statistically significant. This result holds for if we restrict our attention to the difference between permanent workers and the matched temporary ones.

3 Empirical Results

3.1 The relation between wage and commuting time

As mentioned at the end of Section 1, the empirical analysis presented in this section will be devoted to the study of the relation between wages and commuting time for those individuals that, during the period of observation, have experienced a change in the type of their contract (permanent or temporary) and/or in their employer.

We noted that the model predicts a negative change in wages for workers moving from firm A to firm B and a positive one for those experiencing the opposite shift. Furthermore, it also suggests that a simultaneous change of employer and contractual status can only be achieved by (some of the) workers moving from A to B, individuals moving from B to A are always offered a temporary contract. Table 5 shows the results of a first level of investigation into this relation. Column 1 presents the estimates of a standard OLS procedure in which the logarithm of the gross hourly wage is regressed against several variables controlling for personal and work related characteristics, including commuting time. The high degree of endogeneity that link wages and commuting time would make any causal interpretation of the coefficient extremely fragile; in this sense the presented coefficients are only indicative of the extent of the correlation between wage and the independent variables. In the second column the set of regressors is augmented by a number of dummy variables in order to control for the race of the individual, sector and year fixed effects. The analysis is then repeated in columns three and four on temporary workers only. Focusing on the coefficients related to travel-to-work time, the positive relation between this variable and the dependent one

	All Workers		Temporary Workers	
Variable	**(1)**	**(2)**	**(3)**	**(4)**
Commuting Time	0.003***	0.002***	0.002***	0.001
	(0.000)	(0.000)	(0.000)	(0.001)
Age	0.068***	0.063***	0.071***	0.066***
	(0.002)	(0.002)	(0.007)	(0.007)
Age^2	-0.001***	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
Education	0.101***	0.094***	0.089***	0.088***
	(0.002)	(0.002)	(0.010)	(0.011)
Tenure	0.013***	0.014***	0.038***	0.038***
	(0.001)	(0.001)	(0.009)	(0.009)
Tenure^2	0.000***	0.000***	-0.001**	0.038***
	(0.000)	(0.000)	(0.000)	(0.000)
Marital Status	0.082***	0.098***	0.067*	0.084**
	(0.006)	(0.006)	(0.039)	(0.040)
Managerial Duties	0.303***	0.293***	0.105***	0.294***
	(0.007)	(0.006)	(0.056)	(0.059)
Union Member	0.024***	0.045***	0.105***	0.125***
	(0.006)	(0.006)	(0.038)	(0.039)
Full-time Part-time	-0.137***	-0.079***	-0.061*	-0.045
	(0.011)	(0.011)	(0.034)	(0.036)
Intercept	-0.034	0.816***	-0.301**	-0.452
	(0.035)	(0.206)	(0.141)	(0.343)
N	29848	29635	1556	1523
R^2	0.448	0.494	0.367	0.407
F	2198.272	600.913	81.231	21.052
Other Controls	No	Yes	No	Yes

Significance levels: $*$: 10% $**$: 5% $***$: 1% ;

Standard Errors into brackets

Other controls are: 7 race dummies, 10 sector dummies, 10 year dummies

Table 5: OLS Relation Wage and Commuting Time

is in line with that already found by Manning (2004) in terms of sign and significance. The main point of interest is certainly given by the lack of a statistically significant relation between wages and commuting time for temporary workers, when the whole set of controls is included. At first sight, the estimated parameter goes against the theory of compensating differentials. As noted in the previous section, non permanent employees earn significantly less than their permanent counterparts, but no evidence of compensation in terms of other working characteristics can be detected at this basic level of investigation.[16]

Table 6 presents the results from the study of a linear model in which the log of hourly wages

[16]The size of the coefficient appears to be smaller comparing to that suggested by Manning. The choice of the set of control variables may be the main source of differentiation among the results.

is regressed against the same set of regressors presented in the previous table augmented by some interaction terms. The aim of these new terms lies in capturing the changes in wages related to the changes in the employment status suggested by the proposed model and summarised in Table 3.

The specification under analysis can be summarized by the following equation which is initially estimated through OLS:

$$ln(w_i) = \alpha + \beta I_i + \gamma X_i + \delta D_i + \epsilon_i \tag{28}$$

where X and D respectively are the matrices of covariates and dummy variables already presented in Table 5, while I includes a number of interaction terms aimed at capturing the multiplicity of changes suggested by the model. The four columns of Table 6 present the estimated results based on different specifications of equation 28, depending on the interaction variables included in the set of regressors. Explicitly, when all the interaction terms are included, equation 28 can be expressed as:

$$\begin{aligned} ln(w_i) = \alpha + \gamma_1\ Commuting\ Time_i + \delta_1\ Different\ Employer_i + \delta_2\ Temp.\ Contract_i + \\ + \delta_3\ Temp\ Contract \times Comm.\ Time_i + \delta_4\ From\ Temp.\ to\ Perm_i + \delta_5\ From\ Temp.\ to\ Temp_i + \\ + \textstyle\sum_{j=1}^{2} \beta_j CDE_{i,j} + \sum_{k=1}^{4} \beta_k DECT_{i,k} + \gamma X_i + \epsilon_i \end{aligned} \tag{29}$$

where the term CDE indicates two interaction terms capturing the changes in employer associated with a change from a temporary to a permanent position or with a movement from a temporary to another temporary contract. The term $DECT$ denotes a set of four variables that indicate whether the simultaneous changes in employer and contract are linked to a decrease or an increase in commuting time. The two variables included in CDE and the four comprised in $DECT$ are mutually exclusive but not collectively exhaustive with respect of the entire set of workers included in the sample. The coefficients obtained in the proposed regressions are interpreted keeping the set of workers that do not experience a change in the contract as the comparison group.

The first row of the table shows that the evidence of a relevant penalty in terms of wages for temporary workers presented in the previous section tends to vanish as more variables are taken into consideration. In all four suggested specifications no statistically significant relation can be found between the salary obtained by a worker and his being employed under a non-permanent scheme (note, nonetheless, that the signs of the estimated parameters are consistently negative

Variable	(1)	(2)	(3)	(4)
Temporary Contract	-0.0298	-0.0328	-0.0293	-0.0307
	(-0.88)	(-0.96)	(-0.86)	(-0.89)
Commuting Time	0.0018***	0.0018***	0.0018***	0.0018***
	(13.01)	(13.00)	(12.57)	(12.55)
Interaction Temp - Comm. Time	-0.0003	-0.0003	-0.0003	-0.0003
	(-0.34)	(-0.36)	(-0.36)	(-0.36)
Different Employer	-0.0005	0.0080	0.0035	0.0066
	(-0.06)	(0.89)	(0.39)	(0.73)
From Temp to Perm.	-0.0132	0.0446**	0.0280	0.0440**
	(-0.75)	(2.06)	(1.35)	(2.01)
From Temp to Temp	0.0171	0.0293	0.0209	0.0305
	(0.49)	(0.75)	(0.54)	(0.78)
Inter. Temp-Perm Diff. Employer		-0.148***		-0.140**
		(-4.13)		(-2.23)
Inter. Temp-Temp Diff. Employer		-0.0280		-0.0726
		(-0.54)		(-0.68)
Inter. Temp-Perm Diff. Employer			-0.157***	-0.0356
With Positive Change in Comm. Time			(-3.27)	(-0.49)
Inter. Temp-Perm Diff. Employer			-0.0988*	0.0231
With Negative Change in Comm. Time			(-1.88)	(0.31)
Inter. Temp-Temp Diff. Employer			-0.0216	0.0405
With Positive Change in Comm. Time			(-0.35)	(0.35)
Inter. Temp-Temp Diff. Employer			-0.0189	0.0432
With Negative Change in Comm. Time			(-0.24)	(0.35)
Constant	0.0560	0.0578	0.678***	0.679***
	(0.63)	(0.65)	(2.63)	(2.63)
R^2	0.463	0.463	0.465	0.465
Adjusted R^2	0.461	0.462	0.464	0.464
Observations	26863	26863	26528	26528

Significance levels: $*$: 10% $**$: 5% $***$: 1%; t-statistics into brackets

Table 6: OLS Relation Wage Interaction Terms

across the different columns). On the contrary, commuting time appears to be systematically compensated. The relevance of the explanatory power of the variable “Temporary Contract” comes again into question observing the lack of any statistical significance of the interaction term between the temporary contract dummy and the amount of time-to-work faced by the sampled individuals.

Having noted that a change in employer is associated with an increase in the hourly wage, but with a coefficient which is not statistically different from 0, it is interesting to see that in the second and in the fourth specification the change from a temporary to a permanent position also goes together with an increase in the wage. In this sense it is extremely relevant that this last result is overruled when the change in contract length (from temporary to permanent) is also associated with a change in employer. The parameter related to this variable tends to confirm the theoretical finding summarized as point 3 in Table 3: a worker moving from one firm to another while simultaneously shifting from a temporary to a permanent contract should observe a reduction in his net utility, due to a decrease in the wage. With respect to the parameter characterizing those workers keeping a temporary job although with a different employer, the model suggests that the net result of such a change in terms of worker utility depends on the direction of the change of employer, whether toward or from the firm closer to the city. Columns 3 and 4 of Table 6 investigate these shifts. In column 3, the interaction terms between changes in contracts and changes in employers are substituted by four new variables obtained by interacting the dropped variables with two dummies indicating a positive or a negative change in the commuting time between periods t and $t-1$. The results previously presented with respect to workers which have experienced a shift from a temporary to a permanent contract tend to be reinforced. Changes from temporary to permanent with a simultaneous increase in commuting time are still related to a decrease in wage, consistent with an overall reduction in workers' utility. With respect to those workers who have changed employers but still work under temporary contracts, the proposed regression does not suggest a clear-cut pattern of modifications in terms of wages. The coefficients of these terms are in fact not statistically different from 0 and show a negative sign, while the coefficient of the dummy for a simple change from a temporary contract to another temporary contract is positive, although also not significant.

The final column of Table 6 presents the results of the regression in which all possible interaction terms and variables are included in the set of regressors. The estimates once more confirm the main findings of the previous stages: the hourly wage appears to be positively correlated with an increase in commuting time and with a shift from temporary to permanent jobs, in line with that suggested by the theory of compensated differentials on the one hand and by a consistent amount of literature on temporary contracts on the other [17]. Nonetheless, also in this specification the parameter relating wages to a simultaneous change in employer and from temporary to permanent status is negative and statistically significant. Once more the pattern suggested by the model, in which a firm is able to attract workers from the other firm even if changing job implies a decrease in his

[17] See, for example, Bentolila and Dolado (1994), Guell and Petrongolo (2000), Booth, Francesconi, and Frank (2002).

	Temporary	Temp to Perm	Temp to Perm Diff. Empl.	Temp to Perm Diff. Empl. Pos. Change
Dep Variable: Wage				
ATT	-0.142***	-0.101***	-0.198***	-0.214***
	(-7.38)	(-3.77)	(-5.57)	(-4.31)
Observations	29627	27045	26863	26863
Dep Variable: Comm. Time				
ATT	3.291***	2.156*	4.739**	
	(3.81)	(1.69)	(2.35)	
Observations	29627	27045	26863	

t statistics in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 7: Propensity Score Matching Estimates

short run utility tends to be confirmed. It is important to underline that several of the implications suggested by the model, including the one discussed above directly come from the strong assumption of a "duopsonistic"market. Yet, the consequences of the introduction of this hypothesis, leading toward a framework in which the best (in terms of commuting time) firm can easily attract all the best workers while the other firm can still pay its employees the reservation wage only, appear to be at least partially confirmed by the empirical analysis presented in this section. In particular the relations between a simultaneous change of employer and of contract duration and worker's utility move in the direction predicted by the theory and give the hypothesis of the existence of a non-competitive labour market some support.

3.2 Selection bias and changes in the contracts.

The bulk of the proposed analysis focuses on the parameters referring to those workers who have experienced a change in their contract, having started their career on a temporary position. This fact suggests the need for an investigation of the presence of sample selection bias.[18] In this respect, two different empirical strategies are implemented. First of all, Table 7 presents the results obtained by performing a propensity score matching procedure on the data employed for the OLS regressions presented in the previous pages.

The proposed estimates summarize the average treatment effects on the treated individuals on the two critical variables, wage and commuting time. The parameters are estimated using propensity

[18] A good review of applied methods in labour economics is given by Picchio (2006).

score matching across the list of variables already used in the previously presented regressions.[19] The four columns present the results depending on the variable chosen for the treatment: holding a temporary contract, having shifted from a temporary to a permanent contract, having performed this last change in employment status with a simultaneous change in employer and finally with the simultaneous change is employer and status is associated with a positive change in commuting time. The comparison group is based on the set of all the workers that do experience the treatment. The coefficients are in line with what already suggested by the OLS procedure. The penalty in terms of wages and time-to-work experienced by the temporary workers is clearly highlighted and the prediction of a lack of immediate compensation as the worker experiences a change in his job status finds an empirical confirmation[20].

An extra step can be taken in order to address the issue of selection bias in the regression analysis. The reference in this case is to the two-step procedure suggested by Heckman (1979). Table 8 presents the results of the second stage, where the dependent variable is still given by the logarithm of the hourly wage, while the first stage analyzes the probability of holding a temporary contract at time $t-1$. The variables used of the first stage are related to the personal characteristics of the individuals and are not included in the second stage. The results of the first stage are presented in Table 9 in Appendix 2.[21]

Two main results emerge from the presented estimates; first of all, the role of selection into temporary employment appears empirically relevant in determining the wage of the worker. In particular, the inverse Mills ratio (λ) is systematically statistically significant and the sign characterizing the coefficient ρ (that is, the correlation between the error terms of the first and second stage equations) suggests that the unobservable characteristics linked to each of the two stages of the analysis are positively correlated. Secondly, none of the explanatory variables meant to capture the changes in the labour status of the individual are significant anymore. It appears evident that as far as the observable characteristics only are taken into consideration, the predictions obtained through the simple theoretical analysis proposed in Section 1 are at least partially confirmed, even if

[19]The procedure employed in obtaining the estimates is based on Abadie, Herr, Imbens, and Drukker (2004); the (one-to-one) matching is exact with respect to age and education.Matching with up to 5 matches per observation has been implemented, obtaining results that are very close to those presented in Table 7.

[20]The missing parameter in the fourth column of Table 7 and related to Commuting Time is not presented as it would not be informative. As the focus of the fourth column is to investigate the propensity score matching with respect to those workers that have experienced a positive change in commuting time within the two periods of observation, the estimated parameter would be by construction positive, statistically significant and much larger in relative size with respect to the other coefficients presented in the same table.

[21]The presented number of observations refers to both stages.

	(1)	(2)	(3)	(4)
Log of Hourly Wage				
Commuting Time	0.0023***	0.0026***	0.0027***	0.0027***
	(3.08)	(3.09)	(3.12)	(3.10)
Interaction Temp - Comm. Time	-0.0006	-0.0012	-0.0013	-0.0013
	(-0.82)	(-1.13)	(-1.19)	(-1.17)
Different Employer	-0.0408	-0.0243	-0.0437	-0.0213
	(-1.20)	(-0.05)	(-1.02)	(-0.43)
From Temp to Perm.		-0.0108	-0.0300	-0.0154
		(-0.22)	(-0.63)	(-0.31)
Inter. Temp-Perm Diff. Employer		-0.0691		-0.0798
		(-1.09)		(-0.87)
Inter. Temp-Perm Diff. Employer			-0.0353	0.0152
With Positive Change in Comm. Time			(-0.54)	(0.17)
Inter. Temp-Perm Diff. Employer			0.0235	0.0741
With Negative Change in Comm. Time			(0.33)	(0.80)
Constant	0.850***	0.859***	0.867***	0.868***
	(4.78)	(4.82)	(4.84)	(4.84)
λ	0.218***	0.217***	0.225***	0.224***
	(4.95)	(4.92)	(5.00)	(4.98)
ρ	0.413	0.412	0.425	0.424
σ	0.529	0.528	0.528	0.528
Observations	35165	35165	35135	35135

Significance levels: $*$: 10% $**$: 5% $***$: 1%; t-statistics into brackets

Other controls are: 7 race dummies, 10 sector dummies, 10 year dummies

Table 8: Heckman Procedure - Second Stage

the occurrence of selection into temporary work in $t-1$ is controlled for. The picture changes when the unobservable characteristics are taken into account. The explanatory power of the dummies representing the changes in working status tends to decrease; this pattern appears to be common to all the relevant variables included in the study presented in this section, with the only exception of commuting time, which still shows a positive and significant relation with the wages of the sampled individuals. The effective applicability of the theory of compensating differential beyond the relation wage-commuting time is extremely complicated in this context, as the short-run wage profile of the workers appears heavily influenced by unobserved characteristics.

4 Conclusions

This paper addresses the applicability of the theory of equalizing differences in a market in which temporary and permanent workers co-exist. Most of the existing literature on temporary employment presents empirical evidence that cannot be easily reconciled with the hypothesis of perfect competition in the labour market and with the assumption of compensating differentials as implied by Rosen (1987). In particular, temporary workers seem to face worse job conditions in terms of wages and travel-to-work distance with respect to their permanent counterparts. This mere observation was taken as a starting point for the development of a simple two-period model based on a duopsonistic labour market, in which workers are characterized by heterogeneous ability level, firms can offer either temporary or permanent contracts and the only original source of asymmetry between the employers is given by the difference in commuting time workers have to face in order to reach the firm. Letting firms Bertrand compete for the best (in terms of ability) workers on a two-period time basis leads to the definition of a number of career profiles. In particular, the model suggests that workers who have been employed on a temporary basis for a firm can subsequently get a permanent job from the other employer under the condition of a lower wage and a longer travel-to-work distance. The opposite patterns in terms of salary and commuting time characterize the individuals that change employer but are still hired on a temporary basis.

All these predictions are then empirically analysed by testing a reduced form of the model. In this respect, the last two sections of the paper are devoted to an empirical study of data from the UK Labour Force Survey, covering an eleven-year period, 1994 to 2004. The focus is on the wages and commuting times of those individuals who have experienced a change in their labour condition during the two periods of analysis. The results of the study, conducted via the inclusion of several interaction terms in the set of regressors explaining the differences in wages across a the two periods, tend to partially confirm the conclusions suggested by the model. In particular, for those individuals simultaneously experiencing a change in employer and shifting from a temporary to a permanent contract the results of the proposed regressions lead to a well defined pattern characterized by a reduction in the wage corresponding to a simultaneous increase in travel-to-work distance. This result can find a justification in the degree of risk aversion of the workers, which might be willing to trade wage for employment certainty. Nonetheless, in the context of the present work, this outcome is entirely driven by the limited amount of competition that characterizes a labour market in which workers play a passive role in the shaping of their contracts. The robustness of the coefficients is tested through different econometric procedures, which suggest that the role of unobservable characteristics in the selection into temporary employment can play an considerable role in the determination of the wage patterns of an individual and reduce the importance of the changes in employer and contract duration in shaping the short-run career trajectory of a worker.

As some of the theoretical predictions cannot be fully confirmed by the proposed empirical analysis, this paper can be seen as first step in a more complicated and general analysis of the differences between temporary and permanent workers. Several theoretical aspects still deserve to be fully investigated, with particular reference to a complete characterization of the career profile of the workers experiencing more than one consecutive spell in temporary employment. With respect to the empirical results, the issue of the effect of unobservable characteristics in the selection into temporary work remains open to further investigation and may constitute a substantial starting point for a new applied study of the features related to different job schemes.

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Appendix 1

Proof of Condition 1

The condition in eq.12 is based on the comparison of the two following two profit functions:

$$\Pi_{0,A}^{Comp} = p\left(\frac{1+\theta}{2}\right) H_{0,A}^{\beta} - \left(\frac{1+\theta}{2} - \alpha(1-c) + \epsilon\right) H_{0,A}$$

$$\Pi_{0,A}^{Coll} = p\left(\frac{1+\alpha(1-c)}{2}\right) H_{0,A}^{\beta} - \alpha c H_{0,A}$$

that we can more simply rewrite as:

$$\Pi_{0,A}^{Comp} = pFH^{\beta} - (F-g)H \tag{30}$$

$$\Pi_{0,A}^{Coll} = pDH^{\beta} - \alpha c H \tag{31}$$

Maximizing the two functions we obtain: $H^*_{Comp} = \left(\frac{F-g}{p\beta F}\right)^{\frac{1}{\beta-1}}$ and $H^*_{Coll} = \left(\frac{\alpha c}{p\beta D}\right)^{\frac{1}{\beta-1}}$ which imply:

$$\Pi_{0,A}^{*,Comp} = pF\left(\frac{F-g}{p\beta F}\right)^{\frac{\beta}{\beta-1}} - (F-g)\left(\frac{F-g}{p\beta F}\right)^{\frac{1}{\beta-1}} \tag{32}$$

$$\Pi_{0,A}^{*,Coll} = pD\left(\frac{\alpha c}{p\beta D}\right)^{\frac{\beta}{\beta-1}} - \alpha c\left(\frac{\alpha c}{p\beta D}\right)^{\frac{1}{\beta-1}} \tag{33}$$

Firm A will opt for competition when $\Pi_{0,A}^{*,Comp} > \Pi_{0,A}^{*,Coll}$ which means:

$$pF\left(\frac{F-g}{p\beta F}\right)^{\frac{\beta}{\beta-1}}-(F-g)\left(\frac{F-g}{p\beta F}\right)^{\frac{1}{\beta-1}}>pD\left(\frac{\alpha c}{p\beta D}\right)^{\frac{\beta}{\beta-1}}-\alpha c\left(\frac{\alpha c}{p\beta D}\right)^{\frac{1}{\beta-1}};$$

$$\left(\frac{F-g}{pF\beta}\right)^{\frac{1}{\beta-1}}\left[pF\left(\frac{F-g}{pF\beta}\right)-(F-g)\right]>\left(\frac{\alpha c}{pD\beta}\right)^{\frac{1}{\beta-1}}\left[pD\left(\frac{\alpha c}{pD\beta}\right)-\alpha c\right];$$

$$\left(\frac{F-g}{pF\beta}\right)^{\frac{1}{\beta-1}}\left[\frac{F-g}{\beta}-(F-g)\right]>\left(\frac{\alpha c}{pD\beta}\right)^{\frac{1}{\beta-1}}\left[\frac{\alpha c}{\beta}-\alpha c\right];$$

$$\left(\frac{F-g}{pF\beta}\right)^{\frac{1}{\beta-1}}\left[\frac{(F-g)(1-\beta)}{\beta}\right]>\left(\frac{\alpha c}{pD\beta}\right)^{\frac{1}{\beta-1}}\left[\frac{\alpha c(1-\beta)}{\beta}\right];$$

$$\left(\frac{F-g}{pF\beta}\right)^{\frac{1}{\beta-1}}(F-g)>\left(\frac{\alpha c}{pD\beta}\right)^{\frac{1}{\beta-1}}(\alpha c);$$

$$(F-g)^{\frac{\beta}{\beta-1}}(pF\beta)^{-\frac{1}{\beta-1}}>(\alpha c)^{\frac{\beta}{\beta-1}}(pD\beta)^{-\frac{1}{\beta-1}};$$

$$(F-g)^{\beta}\frac{1}{pF\beta}<(\alpha c)^{\beta}\frac{1}{pD\beta};$$

$$\frac{(F-g)^{\beta}}{(\alpha c)^{\beta}}<\frac{F}{D}.$$

■

Discussion on Condition 2

Equation 21 stated:

$$\lambda_B \geq \frac{\Pi^n_{1,B}-Z_2}{Z_1-Z_2}.$$

which can be explicitly rewritten as:

$$\lambda_B \geq \frac{\begin{array}{c} p\ \Psi X^{\beta}_{0,B}-dX_{0,B}+ \\ -p\ (\Psi_B+\Lambda_B)\ (X_{0,B}+N_{0,A})^{\beta}-dX_{0,B}-\alpha(1-c)N_{0,A}\end{array}}{\begin{array}{c} p\ (\Psi_B+\Gamma_B)\ (X_{0,B}+N_{0,A})^{\beta}-d\left(X_{0,B}+N_{0,A}\right)+ \\ -p\ (\Psi_B+\Lambda_B)\ (X_{0,B}+N_{0,A})^{\beta}-dX_{0,B}-\alpha(1-c)N_{0,A}\end{array}} \tag{34}$$

and simplified into:

$$\lambda_B \geq \frac{p[\Psi X_{0,B}^{\beta} - (\Psi + \Lambda)(X_{0,B} + N_{0,A})^{\beta}] + \alpha(1-c)N_{0,A}}{p(\Gamma - \Lambda)(X_{0,B} + N_{0,A})^{\beta} - \delta N_{0,A}} \tag{35}$$

Taking into account the fact that λ_B is to be interpreted as a probability, it must be true that $\lambda_B \in [0, 1]$. The RHS, on the other hand can achieve different values according to the specifications of the parameters affecting it. Of course observing $RHS < 0$ would imply that the inequality presented in eq. 35 is always satisfied, while a value above 1 would automatically rule out the possibility that firm B will hire the $N_{0,A} = h_A H_{0,A}$. This last case is very simple to analyze. $RHS > 1$ implies:

$$\frac{p[\Psi X_{0,B}^{\beta} - (\Psi + \Lambda)(X_{0,B} + N_{0,A})^{\beta}] + \alpha(1-c)N_{0,A}}{p(\Gamma - \Lambda)(X_{0,B} + N_{0,A})^{\beta} - \delta N_{0,A}} > 1$$

which can be rewritten as

$$p[(\Psi + \Gamma)(X_{0,B} + N_{0,A})^{\beta} - (\Psi X_{0,B})^{\beta}] < dN_{0,A}$$

whose interpretation is straightforward: Firm B will never hire any worker from A in the case where the total cost of hiring the new employees overcomes the revenues firm B will make in the event the workers are believed to be highly productive.

The case $RHS < 0$ is satisfied under the condition that the numerator $\mathcal{N}$ and the denominator $\mathcal{D}$ show a different sign. In particular, noting that:

$$\Psi X_{0,B}^{\beta} - (\Psi + \Lambda)(X_{0,B} + N_{0,A})^{\beta} < 0$$
$$(\Gamma - \Lambda)(X_{0,B} + N_{0,A})^{\beta} > 0$$

by construction, then the following conditions must hold:

$$p\ [(\Psi + \Lambda)(X_{0,B} + N_{0,A})^{\beta} - \Psi X_{0,B}^{\beta}] > \alpha(1-c)N$$
$$p\ [(\Gamma - \Lambda)(X_{0,B} + N_{0,A})^{\beta}] > \delta N$$

which imply that as long as the additional costs of the new temporary workers ($\alpha(1-c)$) are below the corresponding revenue gains obtained by B, and as long as the gain from hiring permanent workers instead of temporary ones overcomes the additional costs (δ) implied by this choice, the inequality in eq. 35 is always satisfied and B always hires the workers from firm A. Of course $RHS < 0$ can also be the outcome of a positive numerator and a negative denominator. Nonetheless, if we rely on the notation introduced in Section 1.2.2, this case could be simply rewritten as $\Pi^n_{1,B} > Z2 > Z_1$; Were this the case, λ_B would simply collapse to 0 and no more workers would be hired by B.

Finally, we can also observe $0 < RHS < 1$. This case corresponds to imposing some constraints on the difference in the ability of the newly hired and the workers B employed in period 1. In the case where both $\mathcal{N}$ and $\mathcal{D}$ are positive, hiring workers on the basis of the ability expected at $t = 0$ is more convenient than hiring them on the basis of the ability observed by A, since $\mathcal{D} > 0$ implies $p\ [(\Gamma - \Lambda)(X_{0,B} + N_{0,A})^\beta] > \delta N$. On the other hand, since $\mathcal{N} > 0$ the gain in revenues from hiring the workers is smaller than its cost, $a(1-c)N$. Hence for both $\mathcal{N}$ and $\mathcal{D}$ positive, firm B should only hire new permanent workers. Nonetheless, this result is not feasible, since $RHS < 1$ leads to:

$$p\ [(\Psi + \Gamma)(X_{0,B} + N_{0,A})^\beta - \Psi X_{0,B}^\beta] < (\alpha(1-c) + \delta)N$$

which implies that the cost of hiring the new permanent workers overcomes the corresponding gain in revenues.

Applying a similar reasoning, we can see that, on the other hand, both $\mathcal{N}$ and $\mathcal{D}$ being negative represents a condition for B for only hiring new temporary workers. In this case the fact that $RHS > 1$ does not introduce any binding constraint.

Appendix 2

	1	2	3	4
Age	-0.0669***	-0.0669***	-0.0672***	-0.0672***
	(-8.95)	(-8.95)	(-8.92)	(-8.91)
Age^2	0.000958***	0.000959***	0.000959***	0.000959***
	(10.54)	(10.54)	(10.45)	(10.45)
Education	0.0659***	0.0661***	0.0663***	0.0664***
	(6.61)	(6.63)	(6.60)	(6.61)
Tenure	-0.166***	-0.166***	-0.164***	-0.164***
	(-25.28)	(-25.27)	(-24.90)	(-24.90)
Tenure^2	0.00342***	0.00342***	0.00339***	0.00339***
	(19.06)	(19.06)	(18.79)	(18.80)
Married	-0.221***	-0.221***	-0.215***	-0.215***
	(-5.97)	(-5.97)	(-5.72)	(-5.72)
White	-0.291***	-0.293***	-0.288***	-0.289***
	(-3.04)	(-3.06)	(-2.98)	(-2.99)
Black Caribbean	-0.607**	-0.606**	-0.592**	-0.591**
	(-2.27)	(-2.27)	(-2.21)	(-2.21)
Black African	-0.0381	-0.0416	-0.0264	-0.0295
	(-0.16)	(-0.17)	(-0.11)	(-0.12)
Indian	-0.136	-0.137	-0.143	-0.143
	(-0.91)	(-0.92)	(-0.95)	(-0.95)
Pakistani-Bangladeshi	-0.219	-0.220	-0.206	-0.207
	(-1.13)	(-1.14)	(-1.06)	(-1.06)
Chinese	-0.0464	-0.0469	-0.0297	-0.0320
	(-0.17)	(-0.17)	(-0.11)	(-0.12)
1994	0.273***	0.273***	0.278***	0.279***
	(3.87)	(3.88)	(3.91)	(3.92)
1995	0.449***	0.449***	0.452***	0.451***
	(6.07)	(6.08)	(6.04)	(6.04)
1996	0.325***	0.326***	0.320***	0.321***
	(4.69)	(4.71)	(4.56)	(4.57)
1997	0.279***	0.279***	0.291***	0.291***
	(4.00)	(4.00)	(4.13)	(4.13)
1998	0.313***	0.313***	0.324***	0.323***
	(4.55)	(4.55)	(4.66)	(4.65)
1999	0.226***	0.226***	0.240***	0.240***
	(3.23)	(3.23)	(3.40)	(3.40)
2000	0.145**	0.145**	0.139*	0.139*
	(1.99)	(1.99)	(1.88)	(1.88)
2001	0.0540	0.0541	0.0575	0.0573
	(0.73)	(0.73)	(0.77)	(0.77)
2002	0.0128	0.0121	0.0200	0.0201
	(0.16)	(0.15)	(0.25)	(0.25)
Constant	-0.312*	-0.310*	-0.328*	-0.328*
	(-1.81)	(-1.80)	(-1.88)	(-1.88)
Observations	35165	35165	35135	35135
Significance levels : $*$: 10% $**$: 5% $***$: 1%				

Table 9: Heckman Analysis - First Stage Probit Regression