Workers and Firms Sorting into Temporary Jobs* (FOR THE ATTENTION OF THE PRINTER: FULL TITLE IS 45 LETTERS LONG AND CAN BE USED AS PAGEHEAD)

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Abstract

The liberalisation of temporary contracts has led to a sizeable share of jobs covered by temporary contracts. The paper proposes a matching model of unemployment in which temporary (fixed-term) and permanent (open-ended) jobs coexist in a long run equilibrium. From the labour demand standpoint, the choice of the type of contract leads to a trade-off between an ex-ante speed of hiring and an ex-post flexible dismissal rate. Empirically, we test with italian longitudinal data whether non-employment spells that lead to a temporary job are shorter on average. The empirical evidence strongly supports our theoretical prediction.

- Key Words: Matching Models, Temporary Jobs

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The liberalisation of temporary contracts, or fixed-term contracts as are often defined in the policy debate, has been the main labour market reform in continental Europe during the last decades. The liberalisation applies only to new hires, so that only new jobs and new vacancies can potentially be advertised and filled with temporary contracts. Existing jobs, covered by open-ended contracts, are not directly affected by the reform. As a result, a two-tier regime has emerged in many continental European markets, with a growing share of temporary contracts, which peaked to 14.5 in 2007, at the outset of the great recession (European Commission, 2010). As the stock of open-ended jobs dies out by natural turnover, many observers and policy analysts wonder whether the share of temporary contracts will eventually absorb the entire labour market. This paper shows that the latter implication is far from obvious, and that permanent and temporary workers are likely to coexist in the long run, even with homogeneous labour from the labour demand standpoint.

In the existing literature, the long-run implication of a labour market with both temporary and permanent contracts are not fully understood. In a pure labour demand setting with risk-neutral homogeneous workers and without market frictions, temporary jobs should indeed take over the entire labour market. Boeri and Garibaldi (2007) study theoretically and empirically the transition from a rigid system with only permanent contracts to a dual system with temporary and permanent contracts. In the aftermath of the liberalisation, no vacancies covered by permanent contracts are posted, and the stock of temporary contracts absorbs the entire workforce. Similar implications are held by various papers (Blanchard and Landier, 2002; Cahuc and Postel Vinay, 2002) and ad hoc assumptions ensure that temporary and permanent contracts coexist in equilibrium.[1]

This paper studies firms and workers' sorting into permanent and temporary contracts in an imperfect labour market. Specifically, it studies vacancy posting in permanent and temporary jobs in a world with matching frictions and direct search. From the labour demand standpoint, a filled job with a temporary and flexible contract is more profitable to a firm, since it allows the firm to easily adjust labour in the face of adverse productivity shocks. However, free entry in each submarket implies that in equilibrium jobs advertised with permanent contracts display a larger job filling rate. A simple trade-off thus emerges between an ex-ante slower job filling rate and ex-post more flexible dismissal rate. In other words, firms that post jobs with temporary contracts face longer job filling rate. This mechanism is akin to wage posting and to the competitive search equilibrium initially proposed by Moen (1997).

From the labour supply standpoint, a similar mechanism emerges. For a given wage within the bargaining set, in the spirit of Hall (2005), risk-neutral workers with heterogeneous and unobservable reservation utility, prefer more job security, i.e. a permanent contract. Yet, inasmuch as job search in the submarket for

[1]In Cahuc and Postel Vinay (2002) temporary and permanent contracts coexist in light of a random and exogenous state permission to fill jobs with temporary contracts. In Blanchard and Landier (2002) all jobs start with a temporary contract, and only a fraction is endogenously converted into a permanent job. Garibaldi and Violante (2005) have similar implications. In a more recent paper, Cahuc et al. (2012) show that permanent and temporary contracts coexist in a search market with random matching and wage bargaining. With respect to the research of this paper, the model by Cahuc et al. does not imply that the job finding rate for temporary worekrs is larger than the job finding rate for open-ended contracts.

temporary workers leads to larger job filling rate, also a *labour supply* trade-off emerges between an ex-ante lower job finding rate and an ex-post larger retention rate.[2] As a result the model features a natural sorting of firms and workers into permanent and temporary jobs.

The simple theory has several implications. First, the coexistence of temporary and permanent contracts implies that in equilibrium temporary jobs lead to a faster job finding rate for workers. This is true even when workers can graduate to a permanent position via a temporary job. Second, the steady state of the model displays both temporary and permanent jobs, with an equilibrium share of temporary jobs that crucially depends on the average duration of temporary contracts and the structure of productivity shocks. Third, when firms have the option to undertake costly training in the aftermath of adverse productivity shocks, the theory clearly implies that workers covered with permanent contracts are more likely to be trained.

While the existing empirical literature on temporary vs. permanent jobs is large, the basic implicit mechanism proposed by the model has not been directly tested. Empirically, we use Italian longitudinal data to test whether non-employment spells that lead to a temporary job are shorter on average. We run duration models of unemployment on a sample of workers who entered the labour market between 1998 and 2003 and find that, other things being equal, the transition intensity of exit towards temporary jobs is higher than to permanent.

The paper proceeds as follows. Section 1 highlights the structure of the model and the basic equations. Section 2 defines and solves the equilibrium. Section 3 introduces the option to train workers in the aftermath of adverse shocks and studies the model with on-the-job search. Section 4 presents the empirical analysis. Section 5 concludes.

1 The matching framework

The labour market consists of a mass one of risk-neutral workers. Workers are fully attached to the labour market and if they are out of work, they actively search for a job. Employed workers are subject to natural turnover and separate from their existing job with a Poisson process with arrival rate equal to s.

Workers differ in their idiosyncratic income from non-employment. The outside flow utility is indicated with z, and we assume that z is time-invariant and not observable to the firms. z is drawn from a continuous cumulative distribution $F(z)$ with upper support z^u. Since z is not observable, workers are identical vis-à-vis the firms. Nevertheless, z will play an important role in our analysis and it should be interpreted as an idiosyncratic utility for leisure. The distribution F is also very important, but as we will show below all our results are general vis-à-vis the exact shape of this distribution. The only restriction we have to impose is that F is a continuous distribution with finite upper support.

[2] A similar implication, at least from the labour supply standpoint, emerges in the quantitative general equilirbium model proposed by Alonso-Borrego et al. (2005). The free entry condition in both markets, a key feature of the mechanism of this paper, is anyway not modeled by Alonso-Borrego et al.

Firms produce with a constant-return-to-scale technology with labour productivity equal to y_h. Each job has an instantaneous probability λ of experiencing a (permanent) adverse shock. Conditional on an adverse shock, the productivity falls to $y_l < y_h$. We further assume that the wage paid is strictly larger than z^u so that the labour market is viable for each worker ($w > z^u$).

Two types of contracts exist in the economy. Temporary contracts and permanent contracts. Temporary contracts can be broken by the firm at will. Firm-initiated separation is not possible with permanent contracts.[3] Firms that hire workers on permanent contracts must rely on workers' natural turnover for downsizing. Firms create jobs by posting costly vacancies, and firms can freely decide to open either temporary or permanent jobs. Keeping open a vacancy, either temporary or permanent, involves a flow cost equal to c. For simplicity, we assume that the vacancy cost is identical for both contracts.

Temporary and permanent contracts are offered in different *submarkets*. In each submarket, the meeting of unemployed workers and vacant firms is described by a well defined matching function m with constant returns to scale. Submarkets are indexed by $i \in [p, t]$ where p stands for *permanent* and t for *temporary*. Unemployed workers can freely move across submarkets but cannot search simultaneously on both. This assumption rules out the possibility that workers find a temporary job and reject it in favour of a future open-ended contract. In this respect, search is directed towards a specific submarket (this hypothesis will be relaxed in section 3). Unemployed workers searching for a permanent job enjoy a fixed exogenous benefit $b > 0$. b is not enjoyed when the worker searches in the temporary submarket. In real-life labour markets, unemployed income often requires a specific on-the-job tenure, and our assumption is fully consistent with this fact.

There are matching frictions in each submarket. We let $m(u_i, v_i)$ be the flow of new matches, where u_i denotes the measure of unemployed workers in submarket i searching for the measure v_i of vacancies; following standard assumptions, we assume that m is concave and homogeneous of degree one in (u_i, v_i) with continuous derivatives. Now define $h_i = m(u_i, v_i)/u_i = m(1, \theta_i) = h(\theta_i)$ as the transition rate from unemployment to employment for an unemployed worker in submarket i and $q_i = m(u_i, v_i)/v_i = q(\theta_i)$ as the arrival rate of workers for a vacancy in submarket i. $\theta_i = v_i/u_i$ is the submarket-specific labour market tightness.[4]

Upon the meeting of an unemployed worker and a vacant firm, each match signs a long-term contract that fix a wage for the entire employment relationship without ex-post renegotiation. In the spirit of Hall (2005), any wage within the parties' bargaining set, at the time of job creation, can be supported as an

[3] The interpretation of dismissal at will in the case of temporary workers is twofold: either firms are allowed to fire whenever the shock occurs, or they are able to set contracts whose expected duration is $1/(s + \lambda)$

[4] The matching function m satisfies the following conditions:

$$\begin{aligned} \lim_{\theta_i \to 0} h(\theta_i) &= \lim_{\theta_i \to \infty} q(\theta_i) = 0 \qquad i = p, t \\ \lim_{\theta_i \to \infty} h(\theta_i) &= \lim_{\theta_i \to 0} q(\theta_i) = \infty \qquad i = p, t \end{aligned}$$

equilibrium. To make the problem interesting, we restrict our attention to wages such that $y_h > w_p > y_l$ and $y_h > w_t > y_l$. In words, this assumption ensures that, conditional on the realization of the adverse shock λ, permanent contracts involve a loss to the firm. Further, we will focus on a constant wage across submarkets, such that $w_p = w_t = w$. Finally, in order to ensure that all workers participate in the labour market, we assume that the upper support of the distribution is lower than the wage, so that $z^u < w$.

The equilibrium of the model is characterised by free entry of firms in each submarket, and workers' sorting condition across submarkets.

1.1 *Value functions and job creation in the permanent market*

Let $U_p(z)$ and $E_p(z)$ denote, respectively, the expected discounted income for an unemployed worker and for an employed one in the permanent market. The Bellman equations are:

$$rU_p(z) = z + b + h(\theta_p)[E_p(z) - U_p(z)] \tag{1}$$

$$rE_p(z) = w + s[U_p(z) - E_p(z)] \tag{2}$$

where r is the pure discount rate, z is the workers' specific outside option and b is the unemployment benefit. Let J_p^h and J_p^l denote, respectively, the present discounted value of a permanent job when productivity is high (y_h) or low (y_l); their formal expressions read

$$\begin{aligned} rJ_p^h &= y_h - w + \lambda[J_p^l - J_p^h] + s[V_p - J_p^h] \\ rJ_p^l &= y_l - w + s[V_p - J_p^l] \end{aligned}$$

When productivity is high, the firm enjoys an operational profit equal to $y_h - w$. The worker leaves at rate s and the firm gets the expected value of a vacancy formally indicated with V_p. Conditional on a productivity shock λ, the firm has no margin of adjustment and experiences a capital loss equal to the difference between the value of a permanent job in high state and its value in bad state $J_p^l - J_p^h$. In the low state, the firm runs an operational loss $y_l - w$ as long as the worker separates at rate s. The asset equation of a vacancy reads

$$rV_p = -c + q(\theta_p)[J_p^h - V_p]$$

Assuming free entry in the permanent market, $V_p = 0$, we have that

$$c = q(\theta_p)J_p^h \tag{3}$$

The previous condition is one of the key equations of the model. It shows that the flow cost of vacancy posting is equal to the expected benefit, where the latter is described as the product of the job filling rate into permanent contract times the value of a filled job. The equation should be interpreted as a labour demand condition for permanent jobs.

Finally note that the value of a filled job can be written as

$$
\begin{aligned}
J_p^h &= \frac{y_h - w}{r+s+\lambda} + \frac{\lambda(y_l - w)}{(r+s)(r+s+\lambda)} \\
J_p^l &= \frac{y_l - w}{r+s} < 0
\end{aligned}
\tag{4}
$$

The latter expression represents the cost associated to having a permanent contract in case of adverse shock.

1.2 *Value functions and job creation in the temporary market*

Workers employed with a temporary contract are dismissed conditional on the arrival rate λ, so that the value of employment reads

$$rE_t(z) = w + (s+\lambda)[U_t(z) - E_t(z)] \tag{5}$$

The value of unemployment depends on the specific outside income and faces a transition probability $h(\theta_t)$

$$rU_t(z) = z + h(\theta_t)[E_t(z) - U_t(z)] \tag{6}$$

Firms hiring on the temporary market are free to dismiss workers conditional on the adverse productivity shock; the value of a filled temporary job and of a temporary vacancy read

$$
\begin{aligned}
rJ_t^h &= y_h - w + (s+\lambda)[V_t - J_t^h] \\
rV_t &= -c + q(\theta_t)[J_t^h - V_t]
\end{aligned}
$$

Assuming free entry also in the temporary market, $V_t = 0$, we have that

$$c = q(\theta_t)J_t^h \tag{7}$$

Similarly to the condition above, equation (7) says that the flow cost of a vacancy in the temporary market is equal to expected benefit, where the latter is described as the product of the job filling rate into temporary contract times the value of a filled job. In other words, equation (7) is akin to a labour demand for temporary jobs.

Before turning to the equilibrium definition, we derive the second key condition of our analysis. Using the free entry condition into the temporary market, one can easily show that a filled temporary job has larger value than a permanent job

$$J_{t,h} = \frac{y_h - w}{r+s+\lambda} > J_{p,h}$$

We are now in a position to establish a key result of our model. The expected value of a vacancy depends on the job filling rate and on the value of a filled job. A labour market with both temporary and permanent jobs is such that

$$q(\theta_t)J_t^h = q(\theta_p)J_p^h$$

where we have just proved that $J_t^h > J_p^h$. This result shows that the coexistence of temporary and permanent contract implies that

$$q(\theta_t) < q(\theta_p)$$

Once the job is filled, firms prefer a flexible contract. They are thus willing to offer both temporary and permanent contracts if the job filling rate for permanent contracts is larger than the job filling rate for temporary contracts. Conversely, this result suggests that the job finding rate of a temporary contract is larger, so that

$$h(\theta_t) > h(\theta_p)$$

The previous result is very important for the the workers' sorting condition between the two submarkets, an issue that we discuss next.

1.3 *Workers' sorting*

In our setting a temporary job features larger turnover than a permanent job. Indeed, not only the job finding rate for temporary jobs is higher, since $h(\theta_t) > h(\theta_p)$, but also their destruction rate is larger since a productivity shock leads to job destruction only for temporary jobs.[5] Workers take as given the job finding rates and optimally decide in which submarket to search for a job.[6] Since workers can freely move across submarkets, the optimal allocation will be

$$U(z) = Max[U_p(z), U_t(z)] \tag{8}$$

The expressions for $U_p(z)$ and $U_t(z)$ are obtained combining (2) with (1) and (5) with (6) to obtain

$$\begin{aligned} rU_p(z) &= z + b + \delta_p[w - z] \qquad (9) \\ rU_t(z) &= z + \delta_t[w - z] \qquad (10) \end{aligned}$$

where $\delta_p = \frac{h(\theta_p)}{r+s+h(\theta_p)} < 1$ and $\delta_t = \frac{h(\theta_t)}{r+s+\lambda+h(\theta_t)} < 1$. Since the discount rates δ_i on the right-hand sides are strictly less than one, the values of unemployment -for given job finding rates $h(\theta_t)$ and $h(\theta_p)$- are monotonically increasing functions of z. In words, the higher the idiosyncratic value for leisure, the higher the lifetime utility of unemployed workers, independently of the market in which they are searching. Since the value functions are monotonic in z, a single value of z that makes the two terms in the max operator of equation (8) may exist. Such reservation value -if it exists- will divide the distribution of workers into distinct and adjacent areas. Formally, in what follows, we thus look for a reservation value of z, call it R, such that the marginal worker (the one with idiosyncratic outside option $z = R$) is indifferent between searching for a temporary or a permanent job, so that

$$rU_p(R) = rU_t(R).$$

[5] The total destruction rate is $s + \lambda$ for temporary jobs and s for permanent jobs.

[6] Once a functional form for the matching function is chosen, θ_i is completely determined by the behaviour of the firms.

Simple algebra on equation (9) and (10) suggests that a non-corner solution for the workers' sorting condition solves

$$b = [w - R](\delta_t - \delta_p) \tag{11}$$

The previous expression is particularly important. The left hand side is the specific income from unemployment that a worker enjoys if she joins the permanent unemployment pool. The right hand side of the expression describes the net benefit of finding a temporary job vis-a-vis finding a permanent job, and crucially depends on the sign of difference between the two discount factors $\delta_t - \delta_p$. Note also that by assumption the reservation value is lower than the wage (recall that an internal solution for the sorting condition requires that $R < z_u < w$). Since the marginal worker must be indifferent between which submarket to enter, equation (11) suggests that a reservation productivity will exists when both sides of equation (11) are positive, so that the two existence conditions read

$$\begin{cases} b > 0 \\ (\delta_t - \delta_p) > 0; \quad \Longrightarrow \quad \frac{h(\theta_t)}{h(\theta_p)} > \frac{r+s+\lambda}{r+s} \end{cases} \tag{Existence}$$

The previous conditions state that the reservation R exists if *i)* a positive unemployment benefit is paid in the permanent submarket and *ii)* if a proportional increase in the job finding rate for temporary jobs is larger than the proportional increase in their destruction rate. Since the wage in the two jobs is the same, the second existence condition suggests that the larger job finding rate for temporary contracts must compensate also for the increase in their destruction rate.

Given the Existence conditions, workers endogenously sort between the two markets and those with $z > R$ search for a permanent job. To further understand the sorting condition, consider the net benefit from entering the permanent unemployment pool $\Delta^p(z) = rU_p(z) - rU_t(z)$ as

$$\Delta^p(z) = b - (w - z)(\delta_p - \delta_t)$$

In light of the existence condition, $\Delta^p(z)$ is clearly an increasing function of z and $\frac{\partial \Delta^p(z)}{\partial z} = -(\delta_p - \delta_t) > 0$. This, in turn, implies that workers join the permanent unemployment pool for $z > R$. Note that the distribution of workers is partitioned into two sections, with impatient workers (those with low z) searching for temporary jobs and those with high z searching for permanent jobs. Formally, there is a proportion of workers $F(R)$ searching into the temporary submarket and a proportion $1-F(R)$ searching in the permanent submarket.

Rearranging equation (11), the formal value of R is

$$R = w - \frac{b}{(\delta_t - \delta_p)}$$

To characterise the reservation productivity consider the following case. First if $b = 0$ than $R = w > z^u$ and all workers search in the temporary submarket as long as $\delta_t > \delta_p$. This results should not be surprising. Since the wage is the same across the two submarkets and no unemployment benefit is paid in this case, from the second existence condition is clear that it is better to search for a temporary job. In such corner conditions the entire distribution of workers look for a temporary job. In addition, when $b > 0$, a larger unemployment benefit leads to a lower reservation value R, so that $\frac{\partial R}{\partial b} < 0$, and searching for a permanent job is more attractive. When the unemployment benefit increases, the marginal worker has a lower reservation value and more workers search for permanent jobs. Conversely, the higher the wage the higher the reservation value, $\frac{\partial R}{\partial w} > 0$. A larger wage makes immediate working more attractive and -given the existence conditions- it implies that more workers search for temporary jobs. Finally, an increase in the discount rate for temporary jobs (δ_t) reduces the reservation value and increases the share of workers into permanent jobs $\frac{\partial R}{\partial \delta_t} < 0$. This is again not surprising, since an increase in δ_t reduces the benefit from a temporary job. The same effect, albeit opposite in sign, works for permanent workers, i.e. $\frac{\partial R}{\partial \delta_p} > 0$.

2 Equilibrium

Having derived the job creation conditions and the workers' sorting condition, the equilibrium is obtained by a triple $\{\theta_t, \theta_p, R\}$, and a distribution of employment across states that satisfy the set of value functions $\left\{J_i^h, J_p^l, V_i, E_i(z), U_i(z) \text{ with } i \in [p,t]\right\}$ and:

- Optimal vacancy posting in each submarket. The value of a vacancy is identical across submarkets and driven down to zero by free entry

  $$V_p = V_t = 0$$

  This in turn implies:

  - Job creation in the permanent market

    $$q(\theta_p)J_p^h = c \qquad \text{(JC, permanent)}$$

  - Job creation in the temporary market

    $$q(\theta_t)J_t^h = c \qquad \text{(JC, temporary)}$$

    which together say that in equilibrium the expected benefit of a permanent job must be equal to the expected benefit of a temporary job.

- Optimal workers' sorting. The marginal worker is indifferent between searching in the market for temporary or permanent jobs

  $$U_p(R) = U_t(R) \qquad \text{(Sorting)}$$

Once a functional form for $m(u_i, v_i)$ is chosen, θ_p and θ_t are determined through job creation conditions; given θ_p and θ_t, the sorting equation yields R. The coexistence of the two submarkets depends on the existence conditions highlighted above.

Proposition. *Temporary and Permanent submarkets coexist in equilibrium as long as the reservation utility* R exists. Further, if R exists, it is also lower than the wage.

The proposition follows simply from the discussion in the previous section. Once we get the triple $\{\theta_t, \theta_p, R\}$, the labour market stocks of temporary employment, permanent employment and unemployment easily follows. See Appendix for the details on the derivation of the stocks.

2.1 *Comparative statics in general equilibrium*

Qualitative aspects of the final equilibrium obviously depend on the values taken by the exogenous parameters. In this section we focus our attention upon the general equilibrium effects of changes in the wage w, the unemployment benefit b and the shock occurrence rate λ. We study the effects of such changes on the triple $\{\theta_t, \theta_p, R\}$, as well as on the unemployment rates, whose values are derived in the Appendix.

- An increase in the wage w leads to a reduction in market tightness in both submarkets and an increase in total unemployment. The labour demand effect is very simple and follows from the job creation condition. An increase in the wage is akin to a standard movement along a downward sloping labour demand. Formally, it follows directly from a simple differentiation of equations JC, permanent and JC, temporary, so that $\frac{\partial \theta_i}{\partial w} < 0$. The general equilibrium effect of the wage w on R is ambiguous. As we saw in the previous section, the partial effect of an increase in wage leads to workers shifting towards temporary jobs (for given θ_i). Yet -from the labour demand effect- both the discount rates also increase and the overall effect is thus ambiguous. Because of the fall in the values of θ_i, total unemployment necessary increases, even though it is unclear the effect on the composition in terms of the unemployment sub-pools.

- From the labour demand standpoint, the level of the unemployment benefit does not have any *direct partial equilibrium effect* on the value of a filled job and on the two labour market tightnesses θ_t and θ_p. This is evident from equations JC, permanent and JC, temporary. All the effects of the unemployment benefit come from the partial equilibrium effect of b on R. An increase in b makes the permanent submarket more attractive for the workers. Since market tightness does not change, permanent unemployment increases and temporary unemployment decreases. The effect on total unemployment is consequently ambiguous.[7]

- An increase in the arrival rate λ has various partial equilibrium effects, and a negative general equilibrium effect on total unemployment. If a shock to the productivity of a match becomes more likely, all firms enjoy the operational profit for a shorter period; the value of a filled job, either temporary or permanent, diminishes and firms are less prone to post new vacancies. From the labour demand effect,

[7] With some algebra it can be shown that an increase in the unemployment benefit increases total unemployment as long as $\lambda < [h(\theta_t) - h(\theta_p)]/h(\theta_p)$.

this implies that both θ_t and θ_p fall. From the workers' sorting condition, an increase in λ is akin to an increase in δ_t and thus it leads to an increase in the pool of workers searching for open-ended contracts. The general equilibrium effect of total unemployment is positive, as job destruction increases and job creation falls. What remains ambiguous is the effect of λ on the combination of the two unemployment pools.

3 Extensions

Having derived the basic model, we proceed now with two simple extensions. The first one is motivated by the empirically robust finding that workers employed in permanent contracts experience larger intake of professional training than workers employed with temporary contracts. The fact has been documented by various papers. Arulampalam and Booth (1998) investigate the relationship between employment flexibility and training using UK data, and find that workers on temporary contracts are less likely to receive work-related training. The same result holds also for Spain (Albert et al., 2005) as well as for the majority of European countries (Bassanini et al., 2007; European Commission, 2010; Oecd, 2002), what recently gave rise to a stream of literature concerning the (negative) impact of temporary employment on labour productivity (Dolado and Stucchi, 2008).

The second extension is motivated by the fact that temporary contracts are often seen as ports of entry into permanent employment. This fact too has been extensively studied empirically. Booth et al. (2002) and Hagen (2003) provide evidence in favour of the port-of-entry hypothesis for the United Kingdom and Germany respectively. According to Addison and Surfield (2009) this holds true also for the United States, although little support for the stepping stone effect was previously found in Hotchkiss (1999) and Autor and Houseman (2002). Some ambiguities emerge also for Italy, where the port-of-entry effect coexists alongside an entrapment one (Berton et al., 2011); a poor stepping-stone performance of temporary jobs is instead found in France (Magnac, 2000), Spain (Güell and Petrongolo, 2007) and the Netherlands (De Graaf-Zijl et al., 2011). In order to account for such facts, we extend the model to allow for on-the-job search among temporary contracts.

3.1 *Training*

We consider the possibility that firms, in the aftermath of an adverse productivity shock, may be able to jump back to the high productivity by undergoing costly training. Specifically, we assume that when the negative shock occurs firms can jump back to the high level of productivity y_h by paying a lump sum cost T in the form of training. As the wage paid to workers is held fixed, we can abstract from the issue of financing. We will show that there exist two bounds $[T_l, T_u]$ such that if $T_l < T < T_u$ only firms in the permanent submarket decide to train workers. The asset equations in the permanent market read

$$
\begin{aligned}
rJ_p^h &= y_h - w + s[V_p - J_p^h] + \lambda[\max(J_p^l, J_p^h - T) - J_p^h] \\
rJ_p^l &= y_l - w + s[V_p - J_p^l] \\
rV_p &= -c + q(\theta_p)[J_p^h - V_p]
\end{aligned}
$$

where the max operator conditional on the λ shocks highlights the training option. On the temporary market the asset equations read

$$
\begin{aligned}
rJ_t^h &= y_h - w + s[V_t - J_t^h] + \lambda[\max(V_t, J_t^h - T)] \\
rV_p &= -c + q(\theta_t)[J_t^h - V_t]
\end{aligned}
$$

We now formally establish under what conditions workers with a permanent job receive training. Since undergoing training transforms a low productivity job into a high productivity job, a firm with a permanent contract will undergo training if

$$J_p^h - T > J_p^l$$

Simultaneously, a firm with a temporary contract will not undergo training if

$$V > J_t^h - T$$

The first condition implies

$$\frac{y_h - w}{r+s+\lambda} + \frac{\lambda(y_l - w)}{(r+s)(r+s+\lambda)} - T > \frac{y_l - w}{r+s} \Rightarrow T < \frac{y_h - y_l}{r+s+\lambda}$$

while the condition on the temporary workers reads

$$T > \frac{y_h - w}{r+s+\lambda}$$

If the cost of training T is large enough so that the exit strategy turns out to be preferable in the temporary market, but not too large, then only firms in the permanent market are induced to train the workers; the lower and upper bounds for T formally read

$$T_{low} = \frac{y_h - w}{r+s+\lambda} < T < \frac{y_h - y_l}{r+s+\lambda} = T_{upp} \tag{12}$$

More generally, it is never the case that workers receive training only in the temporary market. Training may be viable on both markets (when $T < T_{low}$), only in the permanent ($T_{low} < T < T_{upp}$), or in none of them ($T > T_{upp}$), depending on the level of T. When T is bounded as in condition (12) the following interesting results follow:

- The temporary market is not affected by training costs. As a consequence, the value of a filled job is the same as in the model without training.

- The value of filled jobs in the permanent market now reads

$$J_p^h = \frac{y_h - w - \lambda T}{r+s}$$

which is larger than in the model without training, but still lower than J_t^h.

- Free entry makes the equilibrium conditions in the temporary submarket independent on T

$$\begin{aligned} c &= q(\theta_p) J_p^h \\ c &= q(\theta_t) J_t^h \end{aligned}$$

This means that in equilibrium the temporary market tightness is the same as without training, while the permanent tightness has now to be higher. As a consequence, on average, in the model with training the job finding rate is higher, the arrival rate of workers for a vacancy is lower, and the steady state overall unemployment is lower.

3.2 *On-the-job search*

This section proposes a further extension of the basic model, as it allows workers (either employed or unemployed) in the temporary tier to search for a permanent job. As we keep the wage constant across submarkets, we do not need to explicitly consider wage determination, one of the (many) difficult issues to be faced when one deals with on the job search (Nagypal, 2006; Shimer, 2003). Nevertheless, the matching function and the definition of market tightness need to be modified and adjusted. In what follows, the number of matches in the permanent submarket reads

$$m_p(u_p + n_t + u_t, v_p) = m_p(u_p + F(R), v_p)$$

where the pool of workers that search for a job is the sum of workers searching only in the permanent market (u_p) and the pool of workers searching in the temporary submarket ($n_t + u_t$). Since the pool of workers in the temporary submarket is the fraction of them with outside utility below R, the second expression immediately follows. As a result, market tightness in the permanent submarket is given by

$$\theta_p = \frac{v_p}{u_p + n_t + u_t} \tag{13}$$

The matching function in the temporary submarket is unchanged and is simply given by $m_t(u_t, v_t)$, with market tightness $\theta_t = v_t/u_t$.

The value functions in the permanent submarket are defined similarly to those of the baseline model (see section 1.1). The only difference is the expression for θ_p, that is defined as in (13) as a way to take into account the composition of the pool of workers searching for a permanent job. Free entry in the permanent submarket implies that

$$q(\theta_p) J_h^p = c$$

where J_h^p is given by (4).

The value functions for the temporary submarket are different, since workers leave temporary jobs at rate $s + \lambda + h(\theta_p)$. When business conditions are good, the value function reads

$$rJ_t^h = y_h - w + [s + \lambda + h(\theta_p)][V_t - J_t^h]$$

while the value of a vacancy is simply given by

$$rV_t = -c + q(\theta_t)[J_t^h - V_t]$$

so that free entry implies that

$$q(\theta_t)J_t^h = c$$

where J_t^h is now given by

$$J_t^h = \frac{y_h - w}{r + s + \lambda + h(\theta_p)} \tag{14}$$

The job creation conditions are still the two key equations, but since now J_t^h depends also on θ_p they form a non-linear system of two equations in two unknowns that can be solved in cascade.[8] The last variable to be determined is the reservation utility R. The value of unemployment in the temporary submarket reads

$$rU_t(z) = z + h(\theta_t)[E_t(z) - U_t(z)] + h(\theta_p)[E_p(z) - U_t(z)]$$

where it is clear that an unemployed worker with low outside utility searches both in the temporary and in the permanent submarket, and can leave the unemployment pool for both types of jobs. Unemployed workers in the permanent submarket behave as in the baseline model, and their asset value equation for the unemployment status is provided by (1). Given the expressions for $E_t(z)$ and $E_p(z)$ and after some steps of algebra (see the Appendix for details), the reservation utility R reads

$$R = w - b\frac{r + s + \lambda + h(\theta_t) + h(\theta_p)}{h(\theta_t)}$$

which implies that $R < w$. Ensuring also that b is small enough,[9] we can easily establish that $0 < R < w$. With respect to the base model, the value of a filled temporary job given in (14) is now not necessarily higher than the value of a permanent one; however, assuming that $J_p^h < J_t^h$, the structure and functioning of this model is identical to the model without on-the-job search. In particular, the basic mechanism that ensures that temporary and permanent jobs coexist in equilibrium survives to this admittedly more realistic scenario. The fact that the value of a permanent job is unchanged while a temporary one is worth less than before means that firms take into account the possibility that temporary workers leave their job moving towards the permanent tier and are consequently less prone to post temporary vacancies; in equilibrium, this leads to a lower tightness in the temporary submarket where a relatively higher congestion from the point of view of the workers emerges.

[8] Starting from job creation in the permanent submarket one gets θ_p; using this result with job creation in the temporary submarket also θ_t is obtained.

[9] Technically the equilibrium of the model must be such that $b < \frac{h(\theta_t)}{r+s+\lambda+h(\theta_t)+h(\theta_p)}$.

4 The empirical analysis

This section tests one of the main implications of the model, namely that the job finding rate in the temporary market is higher than on the market for open-ended contracts. Italy is in this perspective put forward as a case-study of dual labour market reforms (Berton et al., 2012; European Commission, 2010). Indeed, over the nineties a strong deregulation of temporary contracts took place alongside a very rigid legislation for open-ended contracts. Such labour market dualism is fully consistent with the spirit of our theoretical labour market with two types of contracts.

The empirical results that we present clearly show that in Italy the job finding rate for temporary jobs is larger than the corresponding job finding rate for open-ended contracts. In addition, we document a high degree of persistence in the labour market segmentation, with workers remaining in the temporary submarkets for subsequent employment spells.

We proceed in the following way. In section 4.1 we spell out the econometric strategy, while in section 4.2 we discuss data and sample selection. In section 4.3 we present our main empirical findings on the different job finding rates (section 4.3.1), on the effects of covariates and on their relationship with those in the literature (section 4.3.2). Finally, section 4.3.3 deals with robustness and unobserved heterogeneity issues.

4.1 *Econometric strategy and specification issues*

In order to carry out our test we adopt a threefold empirical strategy. We initially take the theoretical analysis very seriously and we separate our sample of unemployed workers into two subsamples: one for workers who find a a temporary job, and one for workers who find a permanent contract.

More formally, in **Model I** we estimate two separate discrete-time duration models of unemployment in which the transition probability from unemployment to job contracts of type $i \in [p, t]$ at time t reads

$$\Pr(y = 1|X) = \frac{\exp(\beta' X)}{1 + \exp(\beta' X)}$$

where y is a binary variable taking the value of one if the worker finds a job and zero otherwise (Allison, 1982; Jenkins, 1995; 2005), and X is a matrix of observable individual variables. In other words, Model I estimates two logit models of the probability of finding a job of type i.

Model I takes the theoretical model literally but faces two major challenges. First, since in our data we do not observe neither the search intentions nor the workers' outside options, in order to identify the specific submarket they choose we rely on their previous jobs, as if such jobs did "reveal" their optimal sorting decision. Formally, with respect to our theoretical model, we assume that the outside option z does not change during employment spells. Second, we need to account for the existence of transitions across submarkets, as some workers who held a temporary job can end up being observed to accept a position under an open-ended contract, and viceversa. In terms of our theoretical model, transitions across submarkets may occur when the outside option changes with respect to the reservation utility R; we then assume that a transition across submarkets "reveals" a draw of a new reservation productivity z. In such cases the initial unemployment spell is treated as a right-censored duration.[10]

Model II assumes that workers can simultaneously search for temporary and permanent jobs. In other words, we relax the idea of direct search and allow the unemployed to search for any type of job. Formally, we model jobless search as a single duration process that is terminated by one out of M exhaustive and mutually exclusive possible destinations, and we thus estimate a discrete-time competing-risk model where in each moment in time the probability of a transition from unemployment to the l-th employment state reads

$$\Pr(y = l|X)\frac{\exp(\beta_l' X)}{1 + \sum_{m=1}^{M} \exp(\beta_m' X)}$$

With data organised in the person-period form, Model II estimates a multinomial logit model in which the dependent variable y takes on $M + 1$ values, referring specifically to unemployment or one of the M employment states considered by the specification. This approach, albeit more distant from our theoretical perspective, does not rely on the strong identifying assumption of the specific utility z implicit in Model I. In this respect, Model II can be read as a robustness check for the results of Model I. The estimate is carried out assuming that $M = 3$, referring specifically to temporary contracts, open-ended contracts and other contracts (self-employment and professional activities).

In both Model I and Model II the matrix X includes controls for gender, age at entry in the labour market (as a proxy for the educational attainment), actual experience (measured as the number of months actually worked since entry in the labour market), occupation in the previous job (blue vs. white collars), former wage, a time-variant flag for the unemployment benefit, firm size and sector in the previous job, the local youth unemployment rate as a measure of labour market prevailing conditions and a set of time-dummies $\{D_t\}$ such that $D_t = 1[T = t]$. This structure is intended to identify the duration dependence shape without assuming any a-priori parametric functional form. In addition, Model II also includes a control for the type of contract held in the previous job, and distinguishes for the actual experience accrued under open-ended, training and apprenticeship, or other temporary contracts.

To check whether the job finding rate is larger for individuals who sign under a temporary arrangement, in Model I and Model II we compare the estimated time-plot of the probability to find a temporary job with that of being hired under a permanent contract, and expect the former to be significantly higher than the latter. Such estimated time plots, reported below, are our key test.

Model III focuses on the role of individual unobserved heterogeneity, and introduces random intercepts

[10] In this perspective another issue must of course be taken into account, i.e. that we do not observe the moment in which z crosses its reservation value R, the initial search process ends and a new one begins. For this reason we estimated this model first assuming that i) changes occur at the beginning of the unemployment spells, and then under the hypothesis that ii) they occur at the end. As differences between the two sets of results are negligble, we deemed this a point of minor relevance and present results under assumption i) only.

in the competing-risk model. Formally, we estimate probabilities of the type

$$\Pr(y = l|X, \alpha)\frac{\exp(\beta_l' X + \alpha_l)}{1 + \sum_{m=1}^{M} \exp(\beta_m' X + \alpha_m)},$$

where $\alpha \perp X$ and $\alpha \sim N(0, \Omega)$ with Ω being an unrestricted variance-covariance matrix allowing for correlation among the M destination states (Model III);[11] Model III is tested against Model II in order to check whether random effects significantly improve the goodness of fit.

4.2 *Data and sample selection*

We estimate the models with Italian administrative data. Specifically, we use the *Work Histories Italian Panel* (Whip), an employer-employee linked database of individual work histories built using information from the Italian social security administration archives. The series covers the period from 1985 to 2003. Its reference population includes all the individuals for which a payment to or from the social security administration is due during the observed period: all the employees of the private sector, civil servants with temporary contracts of any type, independent contractors, professionals without a dedicated social security fund, craftsmen, traders and unemployed workers who receive an unemployment benefit. Temporary arrangements include fixed-term direct-hires, apprenticeship, temporary agency work, training and independent contracts.[12]

Sample selection aims at overcoming the main limitations of the data. As full liberalisation of temporary contracts was enforced in Italy at the end of 2001, we select all the unemployment spells started from January 2002 and experienced by workers who entered the labour market in 1998 or later at the age of 19 to 29.[13] The focus on entrants allows us to observe the whole dynamics of workers' careers and to keep a detailed track of one's experience, thus minimising possible problems that would otherwise arise was the initial portion of one's career not observed, and fully prevents left-truncation issues. The purpose of conditions on age at entry is in turn twofold: on the one hand the lower bound at 19 years old makes our sample more homogeneous, since selected workers are very likely to hold at least a high school degree; on the other hand, the upper bound drops from the sample most of those workers wrongly defined as entrants, but having instead had other previous relevant work experiences that, again, are not observed in the data.

The main concerns with administrative data relates to the identification of unemployment spells. A worker who is not observed at work in Whip may potentially be *i)* unemployed *ii)* out of the labour market or *iii*) employed in an unobserved portion of the labour market. Unemployment is formally identified only when the unemployed workers receive a benefit, while unsupported unemployment, non-participation or

[11] Estimation under the assumption that α follows a discrete distribution having non-zero probabilities over two points of support does not affect the results. Multinomial logit models with random intercepts have been estimated using GLLAMM: see Skrondal and Rabe-Hesketh (2003).

[12] An extension to 2004 became available after our analysis was run; for further details see www.laboratoriorevelli.it/whip.

[13] We define entrants those workers who are never observed in the data before 1998; 1998 has been chosen as a cut point since work arrangements were not observed in full details before.

unobserved employment cannot be distinguished. In order to minimise the possibility that an individual not observed at work in the data is instead actually working, we drop from the sample all the workers who had even a single temporary work experience in the public sector. Unobservable regular employment is indeed almost completely absorbed by open-ended contracts in the public sector and transitions from private to public sector are extremely unlikely in Italy.[14]

Non-participation is then narrowed down by excluding individuals with work experiences as traders or craftsmen (since self-employment has a negligible leakage to dependent work in the private sector: see Berton et al. (2011)), in the agricultural sector (in which, according to anecdotal evidence, temporary layoffs are widely used) and by right-censoring at 18 months all the sampled spells. Finally, as usually done with administrative data (Garibaldi and Pacelli, 2008), we dropped all the spells lasting up to two months since they may hide voluntary job-to-job transitions and thus a relevant share of the search activity. We also limit our analysis on full time jobs.

The resulting sample amounts to 5,296 individuals, for a total of 5,756 unemployment spells and 38,173 monthly person-period observations. Table 1 provides some descriptive statistics.

Table 1: Descriptive Statistics

Individuals: 5,296			
Entry year	%	*Gender*	%
1998	8.8	Male	64.4
1999	13.0	Female	35.6
2000	16.7		
2001	19.6	*Age at entry*	%
2002	29.2	19-24	70.4
2003	12.8	25-29	29.6
Spells: 5,756			
Failure event		%	*Mean duration (months)*
Censored		65.4	9.8
Permanent		10.5	6.7
Temporary		22.4	7.0
Other		1.7	7.0
Occupation	%	*Work area*	%
Blue collars	81.7	North-west	24.4
White collars	18.3	North-east	20.8
		Center	21.9
		South	32.9

Source: own elaborations on Whip data

4.3 *Estimation results*

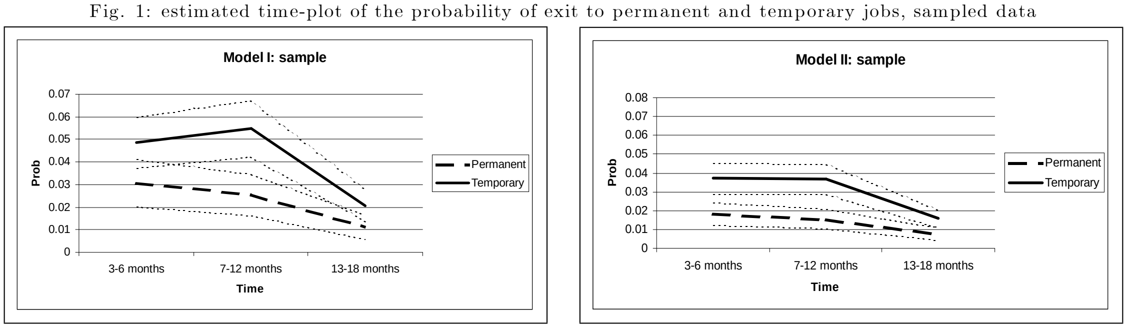
The estimates of Model I and Model II are reported in Table 2. The estimates of Model I, where exit to temporary and permanent contracts are considered separately, appear under columns 1 to 4. The benchmark

[14] In 2002 and 2003 Whip accounts for an average stock of 15,930,395 and 16,287,836 employed workers respectively. In the same years total employment was 22,241,000 and 22,289,000 (LFS data from the National Statistical Office, Istat) while the number of workers with an open-ended contract in the public sector was about 3.4 million (see Di Pierro (2010) on data from the Department of National Accounts). Under the hypothesis that non-regular workers do not appear in the LFS, permanent workers of the public sector represent therefore 54-57% of relevant unobserved employed workers. As in reality (some) non-regular workers instead appear in the LFS, this represents a lower bound. According to Lisi (2009) in those years non-regular employment represented in Italy a share of 12.7% and 11.6% of the total amount of work. Applying these shares to total employment, one gets that non-regular workers were 2,824,607 in 2002 and 2,585,524 in 2003; were they all included in the LFS (upper bound scenario), permanent workers of the public sector would represent almost 100% of unobserved regular employment.

category is unemployment in both cases. The estimates of Model II -the competing-risk model- are presented under columns 5 and 6. In Model II the benchmark is provided by exits to permanent contracts.

4.3.1 The job filling rate to temporary and permanent contracts. In order to assess whether unemployment duration to a temporary job is actually shorter than to a permanent job, we compare the estimated time-plot of the probability of exit towards the two types of contract. Fig. 1 compares Model I (left panel) and Model II (right panel) when probabilities are computed on sampled data. Fig. 2 focuses on Model I and presents probabilities for four given worker profiles, namely men (left panels) and women (right panels) who entered the labour market either at the age of 19 (i.e. after high school: upper panels) or at 23 years old (after a university degree: lower panels). Analogously, Fig. 3 exploits estimates from Model II to further distinguish the profiles proposed in Fig. 2 by the work arrangement that preceded unemployment, namely temporary (with the exclusion of training contracts: upper panels) or open-ended (lower panels).[15] In all plots solid lines represent the probability of exit to temporary jobs, dashed lines stand for the probability to find a permanent job and thin dotted lines are 95% confidence intervals. Our theory predicts that the probability of exit to temporary jobs lies above that of finding a permanent job. This turns out to be the case in all plots, and represents the main empirical finding of our paper. In addition, it is fully consistent with our theoretical perspective.

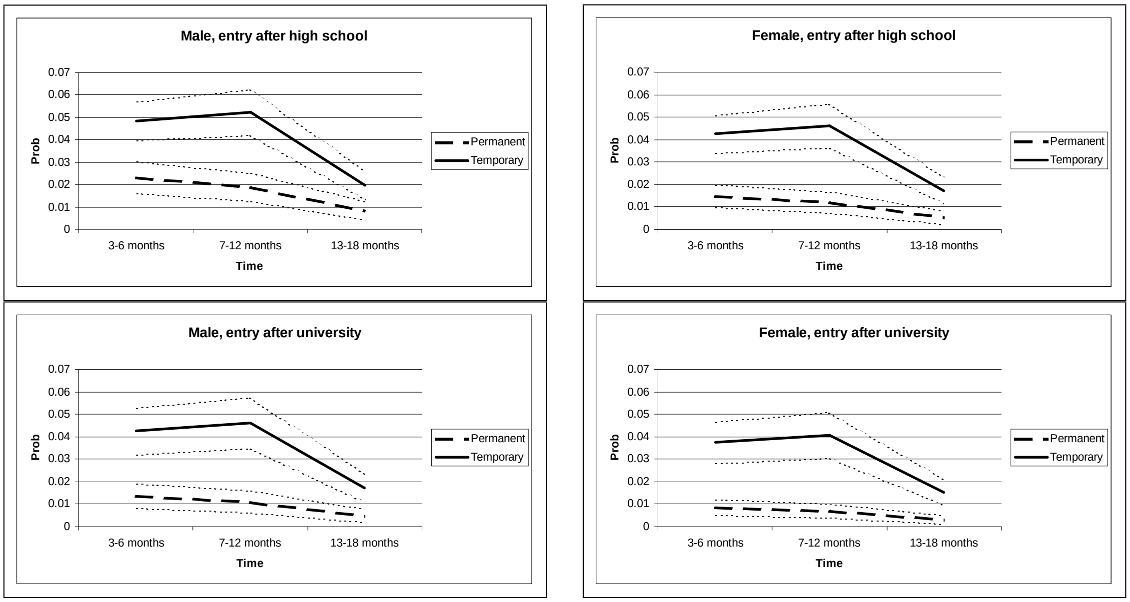
Fig. 1: estimated time-plot of the probability of exit to permanent and temporary jobs, sampled data



Source: own elaborations on Whip data

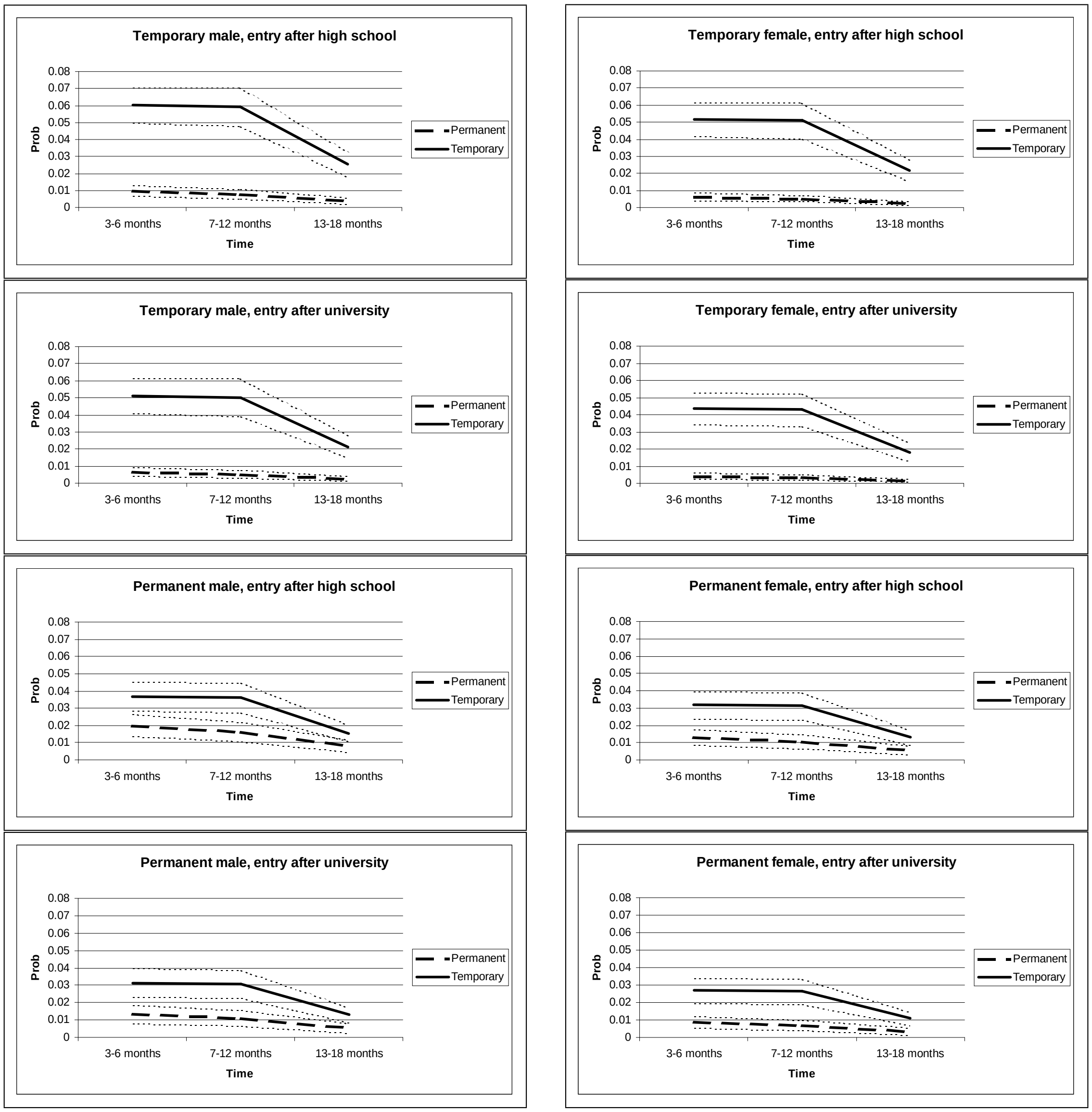
[15] A work experience of one year has been assumed in all cases; the other variables have been set at the sample means.

Fig. 2: estimated time-plot of the probability of exit to permanent and temporary jobs for given worker profiles, Model I



Source: own elaborations on Whip data

Fig. 3: estimated time-plot of the probability of exit to permanent and temporary jobs for given worker profiles, Model II



Source: own elaborations on Whip data

4.3.2. The effects of covariates. For the interpretation of the coefficients of the control variables we consider the two models jointly. With respect to gender, women are less likely than men to find a job of any type, either permanent or temporary, and more at risk to remain unemployed (negative coefficients under columns 1 and 3). When the two perspectives of temporary and permanent employment are then compared directly (column 5) a higher probability of the former with respect to the latter emerges. This is consistent with the idea that employers are less prone to hire young women in general, and in particular under an open-ended contract, due to the risk of maternity leaves and a poorer attachment to the job (Morris and Vekker, 2001; Petrongolo, 2004).

In administrative data, age at entry is expected to capture educational attainment and the weaker attachment to the labour market of young workers (Bover and Gomez, 2004). This is confirmed in our estimates, as older workers are relatively less likely to find a temporary job than a permanent one (negative coefficient under column 5). Institutional features may amplify this result, as training contracts and apprenticeship become unavailable after a given age; this may displace older workers in the temporary submarket, who, upon losing a job, cannot be hired as trainees or apprentices, thus facing a higher risk of being unemployed than to find a new temporary job (negative coefficient under column 3). Up-or-out rules theories (e.g. O'Flaherty and Siow, 1992) contribute to explain the same evidence.

The effect of experience should be considered alongside the previous work arrangement. At first glance, indeed, actual experience, measured as the number of working months since entry, reduces the probability to be unemployed and increases that of working, both under temporary and under permanent contracts (Model I). This is consistent with the idea that work experience increases both technical and relational skills, which in turn enhance employability (Devicienti et al., 2008). This picture changes once the work arrangement in the previous job is taken into account and actual experience is distinguished with respect to the type of contract under which it was accrued (Model II). First of all, workers who held a temporary job of any type are significantly more likely to find another temporary job than those who before unemployment were on an open-ended arrangement. In other words, a strong contractual persistence emerges in Italy (Berton et al., 2011). This feature is observed also in Spain (Amuedo-Dorantes, 2000; Güell and Petrongolo, 2007), the country widely considered as the epitome of reforms at the margin, and is explained by our theoretical model in terms of persistence of the workers' outside option z. Second, while experience under open-ended contracts and under training arrangements reduces the relative probability of exit to a temporary job with respect to a permanent one (negative coefficients under column 5), the number of months worked under other temporary contracts does not affect the employment outcomes. As a result, the career paths of permanent and temporary workers look divergent, with only trainees and apprentices that may potentially compensate the initial negative gap through work experience. This result, in the spirit of Doeringer and Piore (1971), qualifies Italy as a dual labour market. With respect to our model, it may be interpreted as a consequence of poor human capital accumulation under temporary work arrangements.

We then expect wage to capture the impact of unobserved individual ability, so that a higher pay should be a signal of higher productivity, and therefore of better employment perspectives. There is however little evidence of this effect in our analysis, as only temporary workers in Model I enjoy a higher probability to be employed in the future when they get a better pay (column 3). This is probably due to the fact that individual wage, for young workers in particular, is not a good signal of individual ability in Italy, as it is almost completely determined by collective agreements and thus exhibits a limited amount of variability once sector and firm size are controlled for (Devicienti et al., 2007).

The strong tie between clerical work and wage and salary independent contracts mirrors into the relatively higher probability of white collars to find a temporary job. Further, the diffusion of non-regular employment in Southern regions, which is likely to substitute temporary employment as a flexibility device, rationalises why the local youth unemployment rate (much higher in the South of Italy with respect to Northern regions) is found to have a negative effect, i.e. to increase the probability to get a permanent position. Firm size enhances one's probability to find a job, both temporary and permanent.

The time-variant dummy for the unemployment benefit eventually deserves a specific comment. According to our theoretical model, the unemployment benefit should push workers into the sub-market for open-ended contracts. While in Model I, consistently with the idea that it raises the reservation wage, the unemployment benefit reduces the job finding rate, in Model II the coefficient, although not significant, is positive, meaning that it enhances the probability of finding a temporary job. To understand such finding one has to bear in mind the very low take-up rate of unemployment benefits in Italy (Immervol et al., 2004), that results from the workers' willingness to avoid activation policies and related administrative controls (Leombruni et al., 2012).[16] Far from measuring one's outside option, getting the benefit may therefore capture the absence of better alternatives.

Table 2: Estimation results from Model I and Model II

	Model I				**Model II**	
	Exit to open-ended		**Exit to temporary**		**Exit to temporary**	
	Coeff.	**Pr > |z|**	**Coeff.**	**Pr > |z|**	**Coeff.**	**Pr > |z|**
Constant	-4.134***	0.000	-1.995***	0.000	2.683***	0.000
Women	-0.449***	0.001	-0.132*	0.070	0.269**	0.024
Age at entry	0.019	0.271	-0.058***	0.000	-0.101***	0.000
Experience						
Actual experience	0.015***	0.000	0.008***	0.010		
Actual exp. under open-ended contracts					-0.025***	0.000
Actual exp. under training contracts					-0.013**	0.042
Actual exp. under other temporary contracts					0.003	0.717
Previous job						
Wage (hunderds of Euros)	-0.003	0.758	0.029***	0.000	0.009	0.289
White collar	-0.614***	0.000	0.099	0.286	0.638***	0.000
Building sector	0.377**	0.011	-0.040	0.754	-0.332**	0.030
Services sector	0.068	0.590	0.004	0.956	0.038	0.746
Firm size: 16 to 50	0.451***	0.001	0.361***	0.000	-0.062	0.660
Firm size: 51 to 100	0.327*	0.054	0.262**	0.033	-0.204	0.232
Firm size: 101 or more	0.274**	0.042	0.388***	0.000	0.013	0.920
Training contract					1.166***	0.000
Other temporary contracts					1.204***	0.000
Time-variant covariates						
Unemployment benefit	-0.233	0.348	-0.097	0.713	0.095	0.756
Local youth unemployment rate	-0.005	0.176	-0.011***	0.000	-0.012***	0.002
Spline						
7 to 12 months	-0.203*	0.058	0.088	0.219	0.184*	0.085
13 to 18 months	-1.038***	0.000	-0.925***	0.000	0.011	0.956
Benchmark	*Unemployment*				*Open-ended*	

Notes: *** 99% significant; ** 95% significant; * 90% significant

Source: own elaborations on Whip data

4.3.3. Discussion and robustness. Although the results appear extremely robust, unobserved heterogeneity may still be an issue, in light of the limited amount of covariates in administrative data. To tackle

[16]In the period under analysis the unemployment benefit in Italy was set at 40% of the wage, with ceilings (Berton et al., 2009).

unobserved heterogeneity we estimate Model III on the subsample of workers for whom we observe at least two spells of unemployment during the relevant period. This forces us to further drop from the sample the workers who move into self-employment, as they are only three, and to estimate a slightly poorer specification. The remaining sample amounts to 446 workers, corresponding to 902 unemployment spells and 10,842 person-period observations. As Model II, once adapted to the new sample, is nested into Model III, we can run a likelihood-ratio test of the hypothesis that the latter significantly improves the goodness of fit provided by the former. The test has a chi-squared distribution with three degrees of freedom, as Model III boils down to Model II under the hypotheses that the variances of the two random intercepts for the non-benchmark employment states (unemployment and temporary work) are zero and that their covariance is zero as well, and reads

$$LR \sim \chi^2(3) = 0.16$$

As $\Pr > LR = 0.984$, the hypothesis that Model III improves the goodness of fit is largely rejected.[17]

In terms of robustness, one may still argue that duration models with random effects (as Model III) rely on the hypothesis of orthogonality between observed and unobserved components, and implicitly rule out the possibility to control for a number of relevant (unobserved) variables such as individual ability and education. This is partly true, but two considerations are in order. First, fixed-effect strategies are not viable in duration models (Magnac, 2000). Second, we adopted complementary strategies aimed at tackling the issue. We first use proxies for both education and individual ability. Then, in both Model I and Model II we estimate robust standard errors by clustering observations by individual. Finally, semi-parametric specifications of duration dependence are proved to be robust to the presence of unobserved components (Dolton and Van der Klaauw, 1999). In addition, we argue that unobserved components -and individual ability in particular- likely lead to an *underestimate* of the parameters of interest. Most skilled individuals are indeed more likely to find an open-ended job, and to find it more quickly; as time goes by, therefore, the sample is left with less skilled individuals more likely to get a temporary contract. Controlling for individual ability would thus reinforce our conclusions.

A final concern may exist about the difference between the arrival rate of job offers and the job accepting rate. In our theoretical model job offers are always viable, which implies that there is no difference between the two rates. In real world labour markets, workers may give up an offer, and keep searching for a better one. What we actually measure is thus the duration until acceptance, and not until the arrival of a job offer as the theoretical model would suggest. But since workers are more likely to give up on a temporary job than on a permanent one, our results lay again on the safe side. We can thus safely conclude that in Italy the duration of unemployment until temporary jobs is shorter than to permanent ones.

[17] For this reason and for its poorer specification with respect to Model II, we do not explicitly discuss the estimates from Model III, which are nonetheless largely consistent with those from the other models. Results remain available upon request to the authors.

5 Concluding remarks

The liberalisation of fixed-term contracts in Europe has led many countries to a two-tier regime, with a growing share of jobs covered by temporary contracts that is particularly pronounced where the employment protection legislation differential with respect to workers with open-ended contracts is largest (Booth et al., 2002). In this perspective the present paper proposes and solves a matching model with direct search in which temporary and permanent jobs coexist in a long-run equilibrium. The intuition is as follows: when temporary contracts are allowed, firms are willing to open permanent jobs inasmuch as their job filling rate is faster than that of temporary jobs. From the labour supply standpoint an analogous trade-off between ex-ante lower job finding rate and ex-post larger retention rate emerges.

The prediction that the job offer arrival rate for temporary workers is higher is supported by our analysis of Italian administrative data. Using duration models of unemployment we find that, other things being equal, the unemployment duration until temporary jobs is shorter than to permanent jobs. To the best of our knowledge the issue of unemployment duration until temporary vs. permanent contracts has been seldom studied directly. The implication that the waiting time for a temporary job is shorter holds in the Netherlands (De Graaf-Zijl et al., 2011), in Slovenia (Van Ours and Vodopivec, 2008) and in Spain (Bover and Gomez, 2004], while an analogous effect does not emerge in France (Blanchard and Landier, 2002) or in the United States (Hotchkiss, 1999).

The theory has further implications. First, workers covered with open-ended contracts are more likely to receive training. Empirical evidence cited above largely supports this implication. Second, the model implies that workers with weak non-employment options give high value in finding a job quickly, thus sorting into the temporary submarket in the spirit of the paper; this implication is also consistent with the idea that higher unemployment benefits allow workers to be more selective in the job search process, thus increasing the job match quality (Belzil, 2001; Caliendo et al., 2009; Fitzenberger and Wilke, 2010; Van der Klundert, 1990). Last, Jahn and Bentzen (2010) argue that during economic upturns unemployed workers are more confident to find a permanent job quickly, what rations labour demand and tightens the market for temporary jobs; this is consistent with another key result of our model, namely that a labour demand trade-off between ex-ante slower job filling rate and ex-post more flexible dismissal rate exists.

A Labour Market Stocks and Flows

Labour supply is the sum of unemployment and employment in each submarket

$$\begin{aligned} u_t + n_t &= F(R) \\ u_p + n_p &= 1 - F(R) \end{aligned}$$

The dynamic evolution of unemployment in the two submarket is given by difference between job creation and job destruction. This implies that

$$\begin{aligned} \dot{u}_p &= sn_p - h(\theta_p)u_p = s[1 - F(R) - u_p] - h(\theta_p)u_p \\ \dot{u}_t &= (s+\lambda)n_p - h(\theta_t)u_t = (s+\lambda)[F(R) - u_t] - h(\theta_t)u_t \end{aligned}$$

Unemployment in each submarket is constant when job creation is equal to job destruction; the steady state expressions for the stocks read

$$\begin{aligned} u_p &= \frac{s[1 - F(R)]}{s + h(\theta_p)} \\ n_p &= \frac{h(\theta_p)[1 - F(R)]}{s + h(\theta_p)} \\ u_t &= \frac{(s+\lambda)F(R)}{s + \lambda + h(\theta_t)} \\ n_t &= \frac{F(R)h(\theta_t)}{s + \lambda + h(\theta_t)} \end{aligned}$$

The coexistence of the two submarkets in equilibrium depends on the existence of a positive reservation outside utility strictly lower than the wage. We show this result in two steps.

B Search on the job

The proof of the existence of the equilibrium in the model with on the job search is based on finding the conditions for the existence of a positive reservation outside utility that is strictly lower than the wage. Once θ_t and θ_p are determined by sequentially solving the job creation conditions system (see section 6), both U_t and U_p are linear functions of z; a positive R therefore exists when the intercept of U_t is larger than the intercept of U_p and its slope is smaller.[18] We will then prove that under the same conditions not only R is positive, but is also strictly lower than w.

The value functions for the supply side of the permanent submarket look as in section 2.1

$$\begin{aligned} rE_p(z) &= w + s[U_p(z) - E_p(z)] \\ rU_p(z) &= z + b + h(\theta_p)[E_p(z) - U_p(z)] \end{aligned}$$

[18] In principle, the existence of a positive R would be shown also under the opposite conditions, i.e. a higher intercept and a smaller slope for U_p; however, as a few steps of algebra will make clear, the slope of U_p is always larger than the one of U_t.

so that the value of unemployment for a permanent worker reads

$$U_p(z) = \frac{(z+b)(r+s)+h(\theta_p)w}{r[r+s+h(\theta_p)]}$$

In the temporary submarket the asset equations are a bit more complicated, since workers leave their temporary jobs not only because of natural turnover, but also when a permanent vacancy becomes available

$$\begin{aligned} rE_t(z) &= w + h(\theta_p)[E_p(z) - E_t(z)] + (s+\lambda)[U_t(z) - E_t(z)] \\ rU_t(z) &= z + h(\theta_t)[E_t(z) - U_t(z)] + h(\theta_p)[E_p(z) - U_t(z)] \end{aligned}$$

Using $E_t(z)$, $E_p(z)$ and $U_p(z)$ one gets the expression for $U_t(z)$

$$\begin{aligned} U_t(z) = & \frac{[r+s+\lambda+h(\theta_p)]z}{[r+h(\theta_p)][r+s+\lambda+h(\theta_t)+h(\theta_p)]} + \\ & \frac{\{(r+s)h(\theta_t)+h(\theta_t)h(\theta_p)+h(\theta_p)[r+s+\lambda+h(\theta_p)]\}\, w}{(r+s)[r+h(\theta_p)][r+s+\lambda+h(\theta_t)+h(\theta_p)]} + \\ & \frac{h(\theta_p)s[(z+b)(r+s)+h(\theta_p)w]}{r(r+s)[r+h(\theta_p)][r+s+h(\theta_p)]} \end{aligned}$$

We are now ready to go through the steps of the proof.

- Condition on the slopes: $\partial U_p/\partial z > \partial U_t/\partial z$

$$\frac{(r+s)}{r[r+s+h(\theta_p)]} > \frac{r+s+\lambda+h(\theta_p)}{[r+h(\theta_p)][r+s+\lambda+h(\theta_t)+h(\theta_p)]} + \frac{sh(\theta_p)}{r[r+h(\theta_p)][r+s+h(\theta_p)]}$$

Using and omitting the common denominator (which is not relevant for the sign) one gets

$$(r+s)[r+h(\theta_p)][r+s+\lambda+h(\theta_t)+h(\theta_p)] - r[r+s+\lambda+h(\theta_p)][r+s+h(\theta_p)] - sh(\theta_p)[r+s+\lambda+h(\theta_t)+h(\theta_p)] > 0+$$

$$\begin{aligned} [r^2+rh(\theta_p)+rs][\lambda+h(\theta_t)] - r\lambda[r+s+h(\theta_p)] &> 0 \Rightarrow \\ r^2h(\theta_t)+rh(\theta_t)h(\theta_p)+rsh(\theta_t) &> 0 \quad \textit{always} \end{aligned}$$

- Condition on the intercepts: $U_p(0) < U_t(0)$

$$\begin{aligned} \frac{b(r+s)+h(\theta_p)w}{r[r+s+h(\theta_p)]} < & \frac{\{(r+s)h(\theta_t)+h(\theta_p)h(\theta_t)+h(\theta_p)[r+s+\lambda+h(\theta_p)]\}\, w}{(r+s)[r+h(\theta_p)][r+s+\lambda+h(\theta_p)+h(\theta_t)]} + \\ & \frac{h(\theta_p)sb(r+s)+h(\theta_p)sh(\theta_p)w}{r(r+s)[r+h(\theta_p)][r+s+h(\theta_p)]} \end{aligned}$$

Multiplying both sides by the common denominator the expression reads

$$\begin{aligned} &(r+s)[r+h(\theta_p)][r+s+\lambda+h(\theta_p)+h(\theta_t)][b(r+s)+h(\theta_p)w]+ \\ &\quad - r[r+s+h(\theta_p)]\{(r+s)h(\theta_t)+h(\theta_p)h(\theta_t)+h(\theta_p)[r+s+\lambda+h(\theta_p)]\}\, w+ \\ &\quad\quad - [r+s+\lambda+h(\theta_p)+h(\theta_t)][h(\theta_p)sb(r+s)+h(\theta_p)sh(\theta_p)w] < 0; \end{aligned}$$

$$[r^2 + rh(\theta_p) + rs][r + s + \lambda + h(\theta_p) + h(\theta_t)]b(r + s) - wrh(\theta_t)[(r + s)^2 + h(\theta_p)(r + s)] < 0;$$

$$[r + s + \lambda + h(\theta_p) + h(\theta_t)]b < wh(\theta_t) \Rightarrow$$

$$b < \frac{wh(\theta_t)}{[r + s + \lambda + h(\theta_p) + h(\theta_t)]} \tag{15}$$

that is the condition for the existence of a positive reservation outside option.

By equating $U_p(z)$ to $U_t(z)$ and solving for $z = R$, we are now in a position to determine its exact value

$$\begin{aligned} Rh(\theta_t) &= h(\theta_t)w - b[r + s + \lambda + h(\theta_p) + h(\theta_t)] \Rightarrow \\ R &= w - b\frac{r + s + \lambda + h(\theta_p) + h(\theta_t)}{h(\theta_t)} \end{aligned}$$

which implies that $R < w$; moreover, under condition (15), $0 < R < w$.

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