Screening Ex-Ante or Screening On-the-Job? The Impact of the Employment Contract

(preliminary and incomplete)

Sara Pinoli
Bocconi University
Tel.: +39-02-58363339
Fax: +39-02-58363316
Email: sara.pinoli@unibocconi.it

Abstract

This paper develops a partial-equilibrium model to describe the firm's decision about the selection and screening of workers in a framework with two types of contracts: permanent and fixed-term. Two are the strategies: screening ex-ante, or recruitment process, and the monitoring practices of new hires, or screening ex-post. The optimal choice is related to the type of employment contract offered by the firm. Screening ex-ante is more likely to be the best strategy in the case of permanent workers, while it may be optimal to monitor temporary employees on-the-job, thus reducing recruitment expenses. The predictions of the model are tested using a UK employer-employee dataset. The estimates show that temporary contracts are associated with lower recruitment effort, in terms of lower cost and higher speed, but this relation depends crucially on the level of the qualification. No significant discrepancy is found in the screening strategy of high-skilled workers.

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1 Introduction

During the last two decades, labor markets have experienced a deep restructuring, both in the U.S. and in European countries. A common phenomenon has been the substantial growth in the use of atypical labor contracts (Table 1). This term refers to fixed-term arrangements (employees hired on the company payroll either for a specific period of time or for a specific project), temporary-help agency employment (workers employed through a temporary help agency),

on-call work and day labor (individuals who are called in on an as-needed basis), independent contractor (formally self-employed, but, *de facto,* they work as subordinate of the unique client) and, more generally, any employment relationship that can be regarded as contingent.[1] In this paper, I will focus the analysis only on those contracts characterized by the temporariness of the employment relationship, and show that the short duration of jobs has relevant implications for the firms' screening strategy.

The literature has focused on the "workers' side of the problem", analyzing, in particular, the impact of labor market reforms on the transition rates to permanent employment. On one hand, flexible contracts may provide young unexperienced workers with a "port-of-entry" into permanent employment. On the other hand, accepting a temporary contract can attach a stigma to workers, reducing their chances to get better opportunities. Both hypothesis have been tested on several national datasets.[2]

In contrast, little effort has been devoted to understanding the effect of temporary contracts on the "employers' side": the availability of various type of contracts, subject to different regulations, affects the maximization problem of the firm. Wasmer (1999) examines the relative demand of temporary workers whithin a matching model where firms can choose between a high- and a low-turnover strategy; hiring a sequence of fixed-term employees, or a permanent set of indefinite-term workers. Goux et al. (2001) estimate the structure of costs of hiring and firing workers and relate it to the employment arrangement. Using a French panel, they show that it is much less costly to adjust the number of temporary employees, than to adjust the number of permanent ones. Similar results are obtained in Abowd and Kramarz (2003), and Kramarz and Michaud (2004). All of these papers start from the assumption that hiring and separation decisions are efficient and use the information about job flows and adjustment costs in order to derive the relation between costs and labor force adjustment. Furthermore they estimate the effect of the contract type. But they do not model the choice of the contract as an outcome of the firm's maximizing problem and its interaction with the cost function. Why do firms decide to spend less in recruiting temporary workers? Are recruitment practices different, depending on the type of contract? Does it affect the resulting employment relationship?

This paper contributes to the literature in this direction. It studies the impact of atypical contracts on both the recruitment process (screening ex-ante) and the monitoring practices (screening on-the-job) of new hires. The two aspects are jointly analyzed in order to take into account the trade-off that is likely to arise between them: the employer will either choose to accurately screen applicants before hiring them or rather detect bad workers on the job, through

[1] Contingent work is generally defined as an employment relationship such that there is neither an explicit nor an implicit contract for long-term employment or in which the minimum hours vary unsystematically (Polivka and Nardone, 1989).

[2] Booth, Francesconi, and Frank (2000) for UK; Canziani and Petrongolo (2001) for Spain; Contini, Pacelli and Villosio (2000) for UK, Germany and Italy; Ichino, Mealli and Nannicini (2004) for Italy find that positive effects are prevailing. While the adverse effects are pointed out in Blanchard and Landier (2001), and Guell and Petrongolo (2004)

supervision. In the former case, the initial cost of recruitment will avoid hiring - and eventually firing - unsuitable workers. In the latter, the initial saving could be compensated by higher firing costs.

A simple, two-period, partial-equilibrium model shows that the optimal strategy depends on the type of contract. Screening ex-ante is the best strategy in the case of permanent workers, while it may be optimal to monitor atypical employees on-the-job, thus reducing recruitment expenses.

The prediction of the model are tested using a cross-section dataset from the UK Data Archive: the "Survey of Employers' Recruitment Practices" (ERP) conducted in the United Kingdom in 1992.[3] It contains detailed information about the recruiting practices of over 5,000 establishments and their five more recent engagements. I construct two indicators of the investment in the screening ex-ante process: speed and cost. They are indicative of the employers' perception of the speed and cost of several available recruitment channels.

Empirical results are consistent with the model predictions: atypical contracts are associated with lower cost of recruitment and higher speed. The discrepancy is higher for low qualifications, while the recruitment choice seems not to be affected by the type of arrangement in the case of high-level occupation.

The rest of the paper is organized as follows. Section 2 presents a simple model in which firms optimally choose between screening ex-ante and screening on-the-job. Section 3 describes the data used fro the empirical analysis. Methodology and results are discussed in section 4. Section 5 summarizes the main findings and concludes.

2 The screening strategy

Opening a vacancy, a firm has to decide how to carry out the recruitment in order to fill the open position with a suitable worker and with the right timing. There exist several channels of recruitment: jobcentres, fee-charging agencies, notices on the press, internal notices, personal reccomendation, direct applications. They differ in costs, effectiveness and speed. For istance, applying to the Jobcentre is cheap and even effective and fast if the firm is looking for an operative, unskilled workers; while it would probably be uneffective when searching for an experienced manager. The choice of the recruitment channel is strictly related to the occupation the firm wants to fill and to the characteristics of the desired applicant. However, this choice also depends on the type of employment contract.

Searching and screening ex-ante applicants entails a cost, in terms of money spent and time devoted. Those costs are sunk: the firm recoups them during the lifetime of the employment relationship, through the surplus produced by the worker. Besides, a more accurate recruitment yields higher probability of hiring

[3] The same dataset has been used by Pellizzari (2004) in order to derive implications about the employers' recruitment strategy. In the work of Pellizzari, the discriminatory variable is the job qualification, while here it is the contract type.

the best applicant and higher expected surplus. Therefore, the firm has to deal with a tradeoff between the ex-ante cost of screening and the ex-post expected gain from screening. The duration of the contract is likely to play a determinant role: the longer is the expected lenght of the employment relation, the smoother the amortization of the initial investment, and the more willing the employer will be to pay for recruitment. Furthermore, when long-term arrangements impose firing tax, it's even more important to closely sort out permanent workers with respect to temporary ones, in order to avoid laid off costs.

A different strategy can be implemented in order to screen workers: a firm could choose to save on recruitment, while investing more in monitoring the new hire, then valuate its performance and, eventually, dismiss the unsuitable employee. The optimality of this strategy depends on the regulation of the employment contract: when firing costs are high,[4] it is probably not convenient to substitute screening ex-ante with screening on-the-job, because, even if bad workers are detected, it could be too expensive to fire them and monitoring costs would be a net loss. Instead, it could be a good choice in the case of atypical contracts, which involve lower layoff costs. Moreover, monitoring requires time, therefore it is implementable only to those workers who are expected to stay in the position long enough. In particular, the employer may decide to fill a vacancy with a fixed-term worker and screen her throughout the flexible arrangement and eventually hire her as permanent. At the end, the confirmed employees will be only the highly productive ones.

Which strategy will prevail depends on the effectiveness of the two procedures - therefore, on the type of the job and on the firm specific characteristics - and on the type of contract is going to be signed. The decision process is detailed in the following simple model.

2.1 A simple model

I consider a two-period partial equilibrium model. I only model the choice of firms and assume that they face no labor supply constraint at the market wage.

Workers are heterogeneous according to their productivity θ, which is not observable. They can be either good (θ_G), with probability p, or bad (θ_B), with probability $1-p$. In both periods, they can be hired under two types of contracts: permanent P (two-period) or temporary T (one-period, renewable) and they quit fixed-term jobs with an exogenous probability $1-\alpha$.[5]

[4] Firing costs are represented not only by dismissal taxes, but also by more subtle and psycological effects: hiring and firing regular workers frequently may prove to tarnish a firm's reputation, making it more difficult for the organization to recruit permanent employees in the future (Davis-Blake and Uzzi, 1993). Furthermore, although U.S. employers are not required to make severance payments to laid-off workers, the particular structure of the unemployment insurance tax-liability system makes dismissal of experienced workers expensive (See Abraham and Houseman, 1994). Therefore, the proposed model can be applied to both liberal and institutionalized labor markets.

[5] In this simple framework, only temporary workers are allowed to quit. This assumption is without loss of generality: results wouldn't change if also permanent workers would quit with

Wages w are exogenous and fixed so that all workers are willing to accept any type of job:[6]

$$w > w_R$$

where w_R is the reservation wage. In addition, I assume that firms would hire only good type workers:

$$\theta_B < w < \theta_G$$

yet, on average, it is profitable to produce:

$$p\theta_G + (1-p)\,\theta_B - w = \bar{\theta} - w > 0$$

The firm decides how much to invest in recruitment and in monitoring of new hires in order to maximize the lifetime expected profit, without discounting the future: $\delta = 1$:

$$\max_{\bar{S},S,M} E(\Pi) = E(\Pi_1) + E(\Pi_2)$$

There are three alternatives: not perform any kind of screening, $\bar{S}$; invest in recruitment, S; or perform monitoring, M. $\bar{S}$ is costless, but do not provide any information about the type of the worker. S and M produce a true signal. The former gives the information - and generate the cost - before the hiring decision; while M takes time, produces the signal in the end of the first period and it refers only to the hired applicant.[7]

In the following, I will assume that $M = S$. This assumption implies that the only difference between recruitment and monitoring is in the mechanism through which they provide the signal, while there is no a-priori convenience of one method wih respect to the other.

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a probability $1-\alpha_p < 1-\alpha$. The higher mobility of fixed-term workers is a well known stylized fact (see, for istance, Bentolila and Bertola 1990) and it is coherent with this framework: only temporary workers can find better opportunity by quitting a job. They can reduce the risk of not being renewed and look for a permanent employment relationship.

[6] To simplify the computation, I do not take into account the positive wage differential in favour of permanent workers, as documented by the recent empirical findings. A comprehensive study by Kalleberg, Reskin and Hudson (2000, data from CPS) emphasize the heterogeneity of the impact of atypical work arrangements on hourly wages: temporary help agency employment and on-call and day labor are generally associated with wage penalties; while contract-company employees and independent contractor can present both higher or lower wages than the regular full-time counterparts. Similar results are obtained by Cipollone, Guelfi (2003, Italian data) on fixed-term and temporary help workers. Segal and Sullivan (1997, U.S.) focus on the temporary services works and confirm the penalties, even if significantly smaller, once job and worker's characteristics are taken into account. Gustafsson, Kenjoh and Wetzels show that is relatively better to be a short-term worker in Netherlands and Sweden, then in Britain or Germany.

[7] This is the simplest case, but the same results hold under more general conditions, provided that the reliability of the signal is positively correlated with the cost of screening ex-ante and ex-post.

2.1.1 Timing

At the beginning of period 1, a vacancy arises in a firm, for a specific position. The job lasts 2 periods, but can be filled either with a permanent contract or as a temporary occupation. I am not modeling the optimal choice of the type of contract: I am assuming that the characteristics of the vacancy and of the firm uniquely identify the best arrangement, which is offered to applicants without bargaining. Then, the employer has to decide how much to invest in recruitment and in monitoring. In any case, one applicant arrives to the firm.

The employer can either spend S in screening ex-ante, or do not perform any screening, $\bar{S}$; and can decide whether to implement monitoring of the new hires, at cost M, or not. Both strategies S and M give a true signal on the type of worker, but the former produces the signal before the hiring decision, while monitoring takes time and the information is provided in the end of period 1. Then, the employer update her expected probability to face a good worker:

$$\mu = pr\left(\theta_G | signal\right)$$

ex-ante probabilities:	p		$1-p$	
workers' type:	θ_G		θ_B	
S or M	◿	◺	◿	◺
signal:	G	B	G	B
ex-post probabilities:	1	0	0	1

and decide whether to hire (h) or not (nh) the applicant.

When no screening is performed, $\bar{S}$, the only piece of information available on the type of the applicant is the population proportions p and $1-p$. Therefore, the ex-post probabilities coincide with the ex-ante probabilities.

In the end, the firm chooses between 3 strategies: S, $\bar{S}$ and $\bar{S}+M$. $S+M$ is not a sensible alternative, given that after S the worker's type is known and there is no need for monitoring.[8]

In the last period, if the vacancy has been filled in period 1, no decisions are taken by the firm: the permanent worker will be still in the job, while the temporary one will be renewed as permanent with probability α. Only if screening on-the-job has been carried out, at the beginning of the second period the employer values the performance of the worker and decides whether to continue (c) the employment relationship with the same worker, or dismiss her (d) and hire another individual.

If the vacancy is still open or the temporary worker has not been renewed, recruitment effort has to be determined. In the second period, monitoring is no more a sensible alternative to screening ex-ante, because the worker cannot be fired afterwards, and the firm would suffer a cost without any advantage.[9]

[8] Note that the cost M is sustained only if the applicant is hired.

[9] See the Appendix and Figure 1 and 2 for a detailed presentation of the timing.

2.1.2 Solution

CASE 1: Permanent contract Permanent contracts last two periods and cannot be broken. Therefore M is never convenient: even if the employer would be able to detect bad workers, she would be not allowed to fire them.[10] In the end, the choice is only between S and $\bar{S}$.

The maximizing problem of the firm is solved backward,[11] starting from the second period. If a worker has been hired previously, no decisions are taken. Otherwise, the firm compares the expected profit of the two strategies S and $\bar{S}$.

a) S :

$$\begin{aligned}
\text{if } \bar{S} \text{ in period 1} \quad &\rightarrow \quad E_2(\Pi|S) = \quad [\theta_G - w - S]\Pr(S = G) + [-S]\Pr(S = B) \\
&\qquad\qquad\qquad\quad = (\theta_G - w)\, p - S \\
\text{if } S \text{ in period 1} \quad &\rightarrow \quad E_2(\Pi|S) = \quad [\theta_G - w - 2S]\Pr(S = G) + [-2S]\Pr(S = B) \\
&\qquad\qquad\qquad\quad = (\theta_G - w)\, p - 2S
\end{aligned}$$

When the signal is positive, it is optimal to hire the worker; while do not hire her is the best response to a negative signal.

b) $\bar{S}$:

$$\begin{aligned}
\text{if } \bar{S} \text{ in period 1} \quad &\rightarrow \quad E_2\left(\Pi|\bar{S}\right) = \bar{\theta} - w_T \\
\text{if } S \text{ in period 1} \quad &\rightarrow \quad E_2\left(\Pi|\bar{S}\right) = \bar{\theta} - w_T - S
\end{aligned}$$

Without screening, any applicant is hired regardless of the signal.

The optimal choice is defined in the following proposition:

Proposition 1 *At time* 2*, the firm chooses to invest on recruitment only if the excess of cost is lower than the expected loss - due to the possibility of hiring a bad type worker - from strategy* $\bar{S}$*:*

$$S \succ \bar{S} \quad \textit{if} \quad S < (1-p)(w - \theta_B)$$

The expected profit in period 2 is

$$\begin{aligned}
\text{if } \bar{S} \text{ in } t_1 \quad &\rightarrow \quad E_2(\Pi) = \max\left\{(\theta_G - w)\, p - S; \bar{\theta} - w\right\} \\
\text{if } S \text{ in } t_1 \quad &\rightarrow \quad E_2(\Pi) = \max\left\{(\theta_G - w)\, p - S; \bar{\theta} - w\right\} - S
\end{aligned}$$

In the first period the choice is between:

[10] Even allowing firms to fire permanent workers, I would have to take into account the dismissal costs. If firing taxes are high enough, results would not change.

[11] See the Appendix for the detailed solution.

a) S :

$$E\left(\Pi|S\right)=2\left(\theta_G-w\right)p+\left(1-p\right)\max\left\{\left(\theta_G-w\right)p-S;\bar{\theta}-w\right\}-S$$

b) $\bar{S}$:

$$E\left(\Pi|\bar{S}\right)=\max\left\{2\left(\bar{\theta}-w\right);\max\left\{\left(\theta_G-w\right)p-S;\bar{\theta}-w\right\}\right\}$$

$$\begin{array}{lll}\text{if } S<p\left(\theta_G-w\right)-2\left(\bar{\theta}-w\right) & \rightarrow & E\left(\Pi|\bar{S}\right)=\left(\theta_G-w\right)p-S\\ \text{if } S>p\left(\theta_G-w\right)-2\left(\bar{\theta}-w\right) & \rightarrow & E\left(\Pi|\bar{S}\right)=2\left(\bar{\theta}-w\right)\end{array}$$

Under the strategy $\bar{S}$, it is not always convenient to hire any applicant in the first period, but it depends on the cost of recruitment. Below a certain threshold, $p\left(\theta_G-w\right)-2\left(\bar{\theta}-w\right)$, it is more convenient not to hire in period 1 and to sustain S in the second period.

After some computation, the following condition is derived:

Proposition 2 *Permanent workers will be screened only if :*

$$S\succ\bar{S}\quad if\quad S<\left(1-p\right)\left[\left(w-\theta_B\right)+p\left(\theta_G-\theta_B\right)\right]$$

In particular:

$$\begin{array}{lll}if\ S<\left(1-p\right)\left(w-\theta_B\right) & \rightarrow & S+S\succ\bar{S}+\left\{S,\bar{S}\right\}\\ if\ (..)<S<\left(1-p\right)\left[\left(w-\theta_B\right)+p\left(\theta_G-\theta_B\right)\right] & \rightarrow & S+\bar{S}\succ\bar{S}+\bar{S}\\ if\ S>\left(1-p\right)\left[\left(w-\theta_B\right)+p\left(\theta_G-\theta_B\right)\right] & \rightarrow & \bar{S}+\bar{S}\succ S+\bar{S}\end{array}$$

CASE 2: Temporary contract In this case, workers can be cheaply fired. Therefore M is a sensible alternative to the recruitment strategies.

A decision is taken in period 2 only if no worker has been hired in period 1, or if the employee has been fired or quitted. The problem is similar to the game solved for the permanent contract in period 2. Hence, the condition under which S is chosen as best strategy is:

Proposition 3 *At time* 2*, the firm chooses to invest on recruitment only if the excess of cost is lower than the expected loss - due to the possibility of hiring a bad type worker - from strategy* $\bar{S}$*:*

$$S\succ\bar{S}\quad if\quad S<\left(1-p\right)\left(w-\theta_B\right)$$

The expected profit in period 2 is:

$$\begin{aligned}
&\text{if } \bar{S} \text{ in } t_1 \quad \rightarrow \quad E_2(\Pi) = \max\left\{(\theta_G - w)\, p - S; \bar{\theta} - w\right\} \\
&\text{if } S \text{ in } t_1 \quad \rightarrow \quad E_2(\Pi) = \max\left\{(\theta_G - w)\, p - S; \bar{\theta} - w\right\} - S
\end{aligned}$$

Let's consider the end of the first period.

If the firm hired in the beginning of period 1 and performed monitoring, then a signal arrives at the end of 1 and the firm will be able to disentangle the type of the worker. Given this piece of information, the employer decides whether to continue the employment relationship or not:

a) M :

$$E(\Pi_2|M) = p\alpha(\theta_G - w) + (1 - p\alpha)\max\left\{(\theta_G - w)\, p - S; \bar{\theta} - w\right\} + \bar{\theta} - w - M$$

The firm continues the employment relationship only with those workers which showed good signal.

b) $\bar{M}$:

$$E\left(\Pi|\bar{M}\right) = (1+\alpha)\left(\bar{\theta} - w\right) + (1-\alpha)\left[\max\left\{(\theta_G - w)\, p - S; \bar{\theta} - w\right\}\right]$$

If monitoring is not performed, no decision are taken in the end of period 1 and the firm always renews the contract, if the worker does not quit.

In the beginning of period 1, the choice is between 3 strategies: S, $\bar{S} + \bar{M}$ and $\bar{S} + M$.

a) S :

$$E(\Pi|S) = (1+\alpha)(\theta_G - w)\, p + (1 - p\alpha)\max\left\{(\theta_G - w)\, p - S; \bar{\theta} - w\right\} - S$$

b) $\bar{S} + \bar{M}$:

$$\begin{aligned}
E\left(\Pi|\bar{S}\right) \quad = \quad & \max\left\{(\theta_G - w)\, p - S; \bar{\theta} - w\right\} \\
& + \max\left\{(1+\alpha)\left(\bar{\theta} - w\right) - \alpha\max\left\{(\theta_G - w)\, p - S; \bar{\theta} - w\right\}; 0\right\}
\end{aligned}$$

$$\begin{aligned}
&\text{if } S < \tfrac{(1+\alpha-\alpha p)(w-\theta_B)+p(\theta_B-\theta_G)}{\alpha} \quad \rightarrow \quad E\left(\Pi|\bar{S}\right) = (\theta_G - w)\, p - S \\
&\text{if } \tfrac{(...)}{\alpha} < S < (1-p)(w-\theta_B) \quad \rightarrow \quad E\left(\Pi|\bar{S}\right) = (1+\alpha)\left(\bar{\theta} - w\right) + \\
&\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\quad + (1-\alpha)\left[(\theta_G - w)\, p - S\right] \\
&\text{if } S > (1-p)(w-\theta_B) \quad \rightarrow \quad E\left(\Pi|\bar{S}\right) = 2\left(\bar{\theta} - w\right)
\end{aligned}$$

When the cost of recruitment is lower than $\frac{(1+\alpha-\alpha p)(w-\theta_B)+p(\theta_B-\theta_G)}{\alpha}$, the optimal decision is not to hire in period 1 and to invest in recruitment in the

second period. Otherwise, it is convenient to hire the applicant and, if $S > (1-p)(w-\theta_B)$, the firm chooses $\bar{S}$ in the second period, or else spends S.

c) $\bar{S}+M$:

$$\begin{aligned} E\left(\Pi|\bar{S}+M\right) &= \max\left\{(\theta_G-w)\,p-S;\bar{\theta}-w\right\} \\ &\quad +\max\left\{\left(\bar{\theta}-w\right)+p\alpha\left(\theta_G-\bar{\theta}\right)-M;0\right\} \end{aligned}$$

$$\begin{array}{lll} \text{if } S<(1-p)(w-\theta_B) & \rightarrow & E\left(\Pi|\bar{S}+M\right)=\left(\bar{\theta}-w\right)-(2-p\alpha)S \\ & & +p(\theta_G-w)\left[1+\alpha(1-p)\right] \\ \text{if } (..)<S<\bar{\theta}-w+p\alpha(\theta_G-w) & \rightarrow & E\left(\Pi|\bar{S}\right)=2\left(\bar{\theta}-w\right)+p\alpha\left(\theta_G-\bar{\theta}\right)-S \\ \text{if } S>\bar{\theta}-w+p\alpha(\theta_G-w) & \rightarrow & E\left(\Pi|\bar{S}\right)=\bar{\theta}-w \end{array}$$

Under the strategy $\bar{S}+M$, it is optimal to hire the applicant only if $S<\bar{\theta}-w+p\alpha(\theta_G-w)$.

In the end, the optimal strategy is choosen according to the following conditions:

Proposition 4 *Temporary workers will be screened only if:*

$$\begin{array}{ll} S\succ\left\{\bar{S}+M;\bar{S}\right\} & \textit{if} \quad S<(1-p)(w-\theta_B) \\ & \textit{or} \quad S<(1-p)\left[w-\theta_B+p\alpha(\theta_G-\theta_B)\right] \\ & \textit{and} \quad (1-p)\left[\theta_B-w+p\theta_G(1+\alpha)\right]<0 \end{array}$$

In particular:

$$\begin{array}{lll} \textit{if } S<(1-p)(w-\theta_B) & \rightarrow & S\succ\left\{\bar{S}+M;\bar{S}\right\} \\ \textit{if } (..)<S<p\alpha\left(\theta_G-\bar{\theta}\right) & \rightarrow & \bar{S}+M\succ\left\{\bar{S};S\right\} \\ \textit{and } \theta_B-w+p\theta_G(1+\alpha)>0 & & \\ \textit{if } (..)<S<(1-p)\left[(w-\theta_B)+p\alpha(\theta_G-\theta_B)\right] & \rightarrow & S\succ\left\{\bar{S};\bar{S}+M\right\} \\ \textit{if } S>(1-p)\left[(w-\theta_B)+p\alpha(\theta_G-\theta_B)\right] & \rightarrow & \bar{S}\succ\left\{\bar{S};S\right\} \end{array}$$

2.1.3 Comparison

Depending on the values of the parameters involved, the optimal recruitment strategy could be either S or $\bar{S}$ for both contracts; or it could imply different recruitment expenditure according to the lenght of the employment relationship. There is a certain set of parameters' values such that the latter equilibrium arises:

Proposition 5 *The optimal recruitment strategy is:*
- $\bar{S}$ if temporary worker
- S if permanent worker
if the following condition holds:

$$(1-p)\left[(w-\theta_B)+p\alpha(\theta_G-\theta_B)\right]<S<(1-p)\left[(w-\theta_B)+p(\theta_G-\theta_B)\right]$$

In particular, the lower is α, the wider is the set of parameters that involve the above-mentioned varied strategy. It will be optimal to invest also on recruiting atypical workers when the contract is likely to be renewed, and the expected duration of the employment relationship is long enough to amortize the cost.

The possibility of performing monitoring on temporary contracts, give rise to another varied strategy:

Proposition 6 *The optimal screening strategy is:*
- $\bar{S} + M$ if temporary worker
- S if permanent worker
if the following conditions holds:

$$(1-p)(w-\theta_B) < S < p\alpha\left(\theta_G - \bar{\theta}\right)$$
$$p\theta_G(1+\alpha) + \theta_B - w > 0$$

There exists a set of parameters such that it is convenient to monitor fixed-term workers, while screening ex-ante the permanent ones. In particular, ceteris paribus, the higher is α, the wider is that interval. When the expected duration of the contract, $(1+\alpha p)$, is longer, it is more convenient to spend in monitoring the temporary hires. Whereas, if the quitting rate is high, then it is not sensible to monitor a worker who could quit next period.

3 Data

Data used in the empirical analysis comes from a detailed employer-engagement dataset about screening ex-ante: the Survey of Employers' Recruitment Practices (ERP) conducted in the United Kingdom in 1992.[12] This study was carried out by the British Social and Community Planning Research (SCPR), on behalf of the Employment Service, in order to provide an understanding of employers' use and perceptions of the various recruitment channels available to them. A selected sample of over 10,000 establishment, drawn by the Census of Employment for 1989,[13] were first contacted in Autumn 1991 via a brief preliminary telephone interview in order to categorize them into *recruiting* - establishment that either had recruited one or more employees in the previous 12 months or had unfilled vacancies at the time of the interview - versus *non-recruiting* establishment. The longer face-to-face interview took place between May and November 1992. Within each establishment, the respondents were selected to be the main person responsible for the recruitment process.

[12] Hales, J., Employers' Recruitment Practices : The 1992 Survey [computer file]. Colchester, Essex: UK Data Archive [distributor], March 1999. SN: 3694.

[13] The 1989 Census covered all existing establishments with 25 or more employees and was supplemented by a random sample of smaller establishment. The sample is not random but designed to ensure that the number of establishments selected in each size category and region was sufficient to allow meaningful analysis. For this reason, small firms and firms outside London and the South East were oversampled. However, weights are provided to recover population proportions.

The questions regarding the establishments were grouped into three sections: a general inquiry about the type of firm and the role of the respondent; the characteristics of the workforce and information about current vacancies and recent recruits; detailed questions about the recruitment practices usually adopted by the firm.

A further set of questions was asked to the 5,635 recruiting establishment. Five of the more recent engagements[14] were selected in order to cover the largest variety of occupational groups, as defined by the Standard Occupational Classification (SOC). This led to a sample of 22,707 engagements, for each of whom detailed information - about the characteristics of the job, those of the newly hired worker, the recruitment methods activated, whether the recruit was still employed ad how satisfied the employer was with her - were collected. Those data allow to identify the factors affecting the screening ex-ante procedures and their relation with the type of contract. Therefore, they are used in order to verify the predictions of the model about recruitment strategy, while no information are available about the monitoring process.

Descriptive statistics of the full sample and of the subsample used in the regressions are shown in Table 2. It is worth noting that atypical contracts (temporary, causal, fixed term and self-employed) account for about one third of the total number of engagements.

The dependent variable is constructed from the answers to questions E39 and E40of the questionnarie:

> E39: `Using the scale on this card [from 1 (=not at all important) to 7 (=very important)], how important a factor in your use of the recruitment method(s) was the speed with which you expected it/they would provide a suitable recruit on this occasion?`
>
> E40: `Looking at the scale again, how important a factor in your use of recruitment method(s) was keeping down the cost of announcing/advertising the vacancy on this occasion?`

They refer to the second most recent engagement and have been asked to all recruiting establishments.

Each answer has been associated with the channel(s) used first in that particular case and indexes of speed (code in E39) and cost (− code in E40) are computed as the average, over firm, of the respective valuation codes. For instance, the cost-index of the channel "`jobcentre`" is equal to the mean of the valuations assigned to E40 by all the establishments which used jobcentre as one of the first channels to recruit the second engagement. In order to allow heterogeneity in the valuation of the same recruitment channel depending on the type of occupation - as motivated in section 2 - the averages have been computed within the engagements for similar jobs.[15] Results are shown in figure 4

[14] An engagement was defined as *"Recruiting an employee, where a new contract of employment is involved"*. This includes internal transfers and promotions.

[15] Indexes have been computed according to two different grouping schemes.

and 5. It is clear that the valuation of each recruitment channel is not general but relative to the job position it has to fill. For istance, reccomendation is the most expensive and fastest channel when looking for highly skilled workers, but the same channel is associated to a low indexes, in absolute value, for low skilled employees.

Then, indicators of the speed/cost efficiency of the recruitment practices are constructed as the mean of the previous index over the channels used first for each single engagement. This means that, if firm f used first channels `"press"` and `"word of mouth"` to fill the vacancy i, then the indicator of the speed, y_{fi}, is given by the average of speed(press) and speed(word of mouth).

In the end, I have two indexes of recruitment effort for each engagement: `speed` and `cost`.

4 Empirical Analysis

This section tests the main predictions of the preceding analysis by empirically studying the link between the type of contracts and the screening effort. The data limitation imply that only the theoretical implications about screening ex-ante could be properly analyzed.

The model suggests that, ceteris paribus, the recruitment channels involved in hiring an atypical worker should be:

a) cheaper: due to the shorter amortization period

b) faster: time spent in recruiting is also an investment that the firm wants to minimize when the contract is temporary. Furthermore, flexible contracts are often implemented in order to fill an unexpected personnel absence or to adjust labor to fluctuations in demand which cannot be precisely forecasted long ahead, therefore the temporary need could be urgent.

4.1 Econometric specification

The relation between screening effort and the type of contract is estimated in a linear framework (OLS) for each of the two indicators:

$$y_{ijf} = screening\_effort = \alpha + \beta_0 W_{ijf} + \beta_1 F_{if} + \beta_2 J_{jf} + \gamma C_{ijf} + \varepsilon_{ijf}$$

Scheme A: skilled (professional associate & technical; professional; management and administration); unskilled (routine unskilled, operatives and assembly, sales, protective and personal service, craft and skilled service, clerical and secretarial)

Scheme B: skilled (professional associate & technical; professional; management and administration); low skilled (sales, protective and personal service, craft and skilled service, clerical and secretarial); unskilled (routine unskilled, operatives and assembly).

The regressions results reported in Tables 3 to 8 refer to the grouping scheme B. Results for scheme A are qualitatively and quantitatively very similar.

$$C_{ijf} = contract\_type = \begin{cases} 0 & \text{typical} \\ 1 & \text{atypical} \end{cases}$$

where W_{ijf} is the matrix of the characteristics of the worker in engagement i, job j, firm f; F_{if} are the firm's specificities - which do not vary across jobs in the same establishment - and job's variables are collected in J_{jf}; namely:[16]

- worker characteristics: gender, age, ethnic group, disability, previous employment status;
- firm characteristics: industry classification code, region, labor force, level of activity, trend of activity, quality of the workforce;
- job characteristics: occupation classification code, initial pay, supervision task, standard recruitment procedure.

I assumed that the choice of the contract precedes the decision over the recruitment procedure, that is C is predetermined. This is true only if I can control for all the relevant regressors which enter both the contract and the screening equations. Infact, even if C comes first, it is determined by almost the same variables that do enter the screening-effort equation. An endogeneity bias comes from the existence of unobservable characteristics of firms and jobs which are grouped in the error term $\varepsilon_{ijf} = e_{ijf} + \eta_j + \eta_f$ and cause inconsistency.

Given the availability of several engagements for each firm, I can correct for the endogeneity bias by estimating a fixed effect (FE) model, which net out both unobservables:

– first step: cancel the firm fixed-effect by taking the average over j

$$\begin{aligned} \bar{y}_{if} &= \alpha + \beta_0 \bar{W}_{if} + \beta_1 F_{if} + \beta_2 \bar{J}_f + \gamma \bar{C}_{if} + \beta_3 R_f + \bar{e}_{if} + \bar{\eta} + \eta_f \\ \tilde{y}_{ijf} &= y_{ijf} - \bar{y}_{if} = \beta_0 \tilde{W}_{ijf} + \beta_2 \tilde{J}_{jf} + \gamma \tilde{C}_{ijf} + \tilde{e}_{ijf} + \tilde{\eta}_j \end{aligned}$$

– second step: cancel the job fixed-effect by taking the average over f

$$\begin{aligned} \overline{\tilde{y}}_{ij} &= \beta_0 \overline{\tilde{W}}_{ij} + \beta_2 \overline{\tilde{J}}_j + \gamma \overline{\tilde{C}}_{ij} + \overline{\tilde{e}}_{ij} + \tilde{\eta}_j \\ \widetilde{\tilde{y}}_{ijf} &= \tilde{y}_{ijf} - \overline{\tilde{y}}_{ij} = \beta_0 \widetilde{\tilde{W}}_{ijf} + \beta_2 \widetilde{\tilde{J}}_{jf} + \gamma \widetilde{\tilde{C}}_{ijf} + \widetilde{\tilde{e}}_{ijf} \end{aligned}$$

An equivalent strategy consist in estimating a simple linear regression model with dummy variables for each job and for each firm.

Furthermore, adding interacted terms to the econometric specifications allows for differentiated effects of contracts depending on occupational level and

[16] Most of those information have been collected for all the sample, but missing values are not unusual. At the end, the subsample on which I estimate the equation is smaller: 3,467 weighted observation with respect to the initial 20,339. Nevertheless, I can still assume that results are representative of the population, given that the composition of the subsample is very closed to the initial one (Table 2).

industry. Those characteristics reflect the varied magnitudes of the model parameter α, and the productivity differential $\theta_G - \theta_B$.[17]

Limitations:

All the results presented in this paper are derived by using the dataset on the recruiting establishments. Therefore, a potential issue is the selection bias. If firms selfselect themselves into one on the two groups, *recruiting* and *non-recruiting*, according to a selection rule s such that:

$$E\left(\varepsilon_{ijf}|W_{ijf}, F_{if}, J_{jf}, C_{ijf}, s_f\right) \neq 0$$

then the estimated coefficients would be inconsistent.

In particular, the selection rule can be written as:

$$\begin{aligned} & & s_f \begin{cases} 1 & \text{if } s_f^* > 0 \quad \text{recruiting establisment} \\ 0 & \text{if } s_f^* < 0 \quad \text{non-recruiting establisment} \end{cases} \\ s_f^* &= S_f\delta + e_{jf} \\ y_{ijf} &= y_{ijf}^* \times I\left(s_f^* > 0\right) = \begin{cases} y_{ijf}^* & \text{if } s_f = 1 \\ - & \text{if } s_f = 0 \end{cases} \end{aligned}$$

s_f^* represents the FOC from maximizing profits on workforce

S_f comprises economic variables likely to affect firm f hiring decision and can include the same regressors as the main equation, y_{ijf}.

Then:.

$$\begin{aligned} E\left(y_{ijf}|W_{ijf}, F_{if}, J_{jf}, C_{ijf}, s_f = 1\right) &= \alpha + \beta_0 W_{ijf} + \beta_1 F_{if} + \beta_2 J_{jf} + \gamma C_{ijf} + E\left(\varepsilon_{ijf}|e_{jf}\right) \\ &= \alpha + \beta_0 W_{ijf} + \beta_1 F_{if} + \beta_2 J_{jf} + \gamma C_{ijf} + \lambda\left(S_f\delta\right) \end{aligned}$$

Therefore, there is no selection bias only if ε_{ijf} is not correlated with e_{jf}. While the bias arises when both the selection equation and the main equation include correlated unobservable variables as regressors. This is likely to be true in this case: the choice of whether to hire new workers, s_f, and how to recruit them, y_{ijf}, depend probably on roughly the same set of variables, observable and unobservable.

By using firm and job fixed effects, the selection rule component, $\lambda\left(S_f\delta\right)$, is canceled out and consistency is ensured.

$$E\left(y_{ijf} - FE_f - FE_j|W_{ijf}, F_{if}, J_{jf}, C_{ijf}, s_f = 1\right) = \alpha + \beta_0\widetilde{\widetilde{W}}_{ijf} + \beta_2\widetilde{\widetilde{J}}_{jf} + \gamma\widetilde{\widetilde{C}}_{ijf}$$

Results are representative only of the recruiting firms, while the dataset does not provide any information to control for differentiated effect of C depending on the hiring decision s_f.

[17] Tables 3 to 5 show results only for the regressions without interacted terms, with contract-occupation interacted terms, and with contract-industry interacted terms. The same set of regressions have been estimated using contract-occupation-industry interacted terms. Results are qualitatively similar but, for brevity, they are not included in the tables.

4.1.1 Results

The recruitment effort equations have been estimated through OLS and FE procedures. Tables 3 and 4 show the estimated coefficient of `contract` in the cost and speed regression, respectively. The estimates for the control variables are included in Tables 5 to 8. The columns (1), (2) and (3) in Tables 5 and 7 correspond to the OLS regressions in Tables 3 and 4, respectively. The columuns(1), (2) and (3) in Tables 6 and 8 correspond to the FE regressions in Tables 3 and 4. The columns (1'), (2') and (3') differ from the (1), (2) and (3) by the inclusion of a further regressor: `urgency`. `Urgency` is a dummy variable equal to 1 when the job position was urgent to be filled[18]. Unfortunately, this information is available only for 2 engagements each firm; therefore the sample size is halves and the results could be misleading, due to the low degree of freedom.

Recruitment cost - Table 3:

Table 3 shows the estimated coefficient of `contract` in the cost-regression. As expected, it is negative and significant both in OLS and FE regressions[19]: overall, firms tend to spend less for screening atypical workers, as claimed in section 2.

Occupation interacted terms are mainly negative and significant, apart from high level occupations, that are associated with not significant coefficients. This is coherent with the model prediction: skilled jobs are characterized by higher variation in productivity related to different personal characteristics of the employee, therefore the loss related to a bad match is bigger and it becomes convenient to invest in screening ex-ante both temporary and permanent applicants.[20]

Coefficients of the industry interacted terms are mainly negative, but `"Energy and water supply"` and `"Other services"` presents a positive coefficient in the FE regression. A thorough analysis of the use of short term contracts in these industry would be needed to explain the result, but this goes beyond the scope of this study.

The control variables (Table 5 and 6) present reasonable estimates: expensive recruitment channels are needed in order to hire individuals currently working, but lower cost is associated to the re-employement or promotion of former employees. The investment in recruitment increases hand in hand with the qualifications and with the wage: the recruitment expeditures are positively related to the future productivity of those employees, which is in line with the simple model.

[18] Urgency corresponds to the question D36: Suppose that for some reason he/she could not have started work till a month later. Would this delay have mattered to you or not?

[19] Note that the coefficient of contract in the FE regression is lower, in absolute terms, than the corresponding coefficient in OLS regression. The difference reflects the endogeneity bias.

[20] Proposition 5 states that it is optimal to invest in recruiting temporary workers when:

$$(1-p)\left[(w-\theta_B)+p\alpha\left(\theta_G-\theta_B\right)\right] < S < (1-p)\left[(w-\theta_B)+p\left(\theta_G-\theta_B\right)\right]$$

It is evident that an increase in $(\theta_G - \theta_B)$ widens the set of parameters under which the condition is satisfied.

Adding `urgency` helps to explain part of the remaining variation in the valuation of the cost of recruitment, but the sample is considerably smaller. The coefficient of `contract` remains negative only when associated with the occupation soc1, `"Routine, unskilled"`, and some of the industry. In FE-Urgency (2') (Table 6), `"Protective and personal service"`, `"Professional associate and technical occupations"` and `"Professional jobs"` interacted terms have positive coefficients. One possible conjecture is that skilled position are filled with temporary arrangements mainly when a specific need arises, requiring a thorough screening; but the results could also be due to small sample bias, given the low number of high skilled engagements.

Recruitment speed - Table 4:

The OLS (1) regression gives a highly significant positive coefficient on `contract`: atypical contracts involve faster recruitment channels.

The specifications with interacted terms confirms the differentiated effect of contract type: time saving on atypical is more important for low qualifications, while it is not the case for skilled job. The coefficients pertaining to high level occupations present negative coefficients, which can be explained by the same conjectures proposed in the previous section.

Table 7 and 8 shows that recruitment involving only standard procedures imply lower speed; more time is devoted to the screening of applicants for qualified positions, especially professional and technical occupation and managers.

Controlling for `urgency` does have any relevant impact on the results, except for the contract coefficient in FE (1'), which turns negative, but the interacted terms are similar to Table 4. As expected, urgent vacancy are filled through faster channels.

5 Conclusion

This paper provides empirical evidence of the lower recruiting effort exerted by employers when hiring temporary workers, in line with the recent literature on the structure of adjustment costs. Results show that firms spend less in hiring temporary workers, with respect to permanent ones. This is especially true for the low-level occupations, while the relation is not significant or even reversed when estimated on the highly-skilled jobs.

Those findings point out that the screening procedure implemented by a firm is not simply a minimizing cost problem, but involve other assessments, in particular the valuation of the impact of screening on the worker's quality. Therefore, when the productivity gap between good and bad workers is high, as it is the case for managers and administrators, then it will be optimal to invest in the recruitment of both temporary and permanent workers.

As the model explains, recruitment is only one of the strategies that a firm can implement in order to control for the new hire's suitability. An alternative

is the monitoring procedure, which need to be further tested when specific data are available.

Even if there is evidence of lower investment in recruiting atypical workers, it cannot be inferred those workers are, in general, of lower quality. A wider analysis is needed, taking into account monitoring, but also training[21] - that is the firm investment in the employees' specific human capital, with positive effect on the productivity - and macroeconomic shocks - which imply higher missmatching with regard to permanent workers.[22]

However, results provided in this paper raise some concerns about the current and prospective productivity of labor. Nagypal (2004) and Abowd et al. (2002) provide some evidence that productivity highly depends on the unmeasured personal characteristics of the employees, than on the human capital accumulation. Therefore, it is more efficient to learn the quality of the match trough screening and monitoring process, than to invest on training. Besides, there is evidence that workers on short-term contract are less involved in training (Arulampalam and Booth (1998)), are more likely to suffer work accidents (Guadalupe (2003)) and are involved in less skilled positions (Felstead et al. (2001) and Felstead and Gallie (2004)). Further analysis is needed in order to assess the impact of temporary contracts on the overall productivity.

[21] See for istance the models developed by Bac (2000) and Felli and Harris (2004); and the empirical evidence in Arulampalam and Booth (1998) and Rix et al. (1999).

[22] The positive effect of temporary contracts in reducing missmatch is found in Alonso-Borrego et al (2004), Blanchard and Landier (2002) and Veracierto (2003).

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6 Appendix: solution of the model

6.1 Permanent Contract:

6.1.1 Timing:

Consider the case of a firm dealing with a vacancy for a permanent worker. Monitoring is no more a suitable alternative, because permanent contracts are characterized by the unbreakability of the employment relationship. The contracts last two years and cannot be terminated before. Therefore, even if screening on-the-job would allow firms to disentangle between good and bad workers, it would not be possible to dismiss the bad ones and the cost of monitoring would not produce any gain. The firm can choose only between strategies S, screening ex-ante, and $\bar{S}$, no screening. If no applicant is hired in period 1, the decision is postponed to period 2.

The timing of the game is detailed in Picture 1.

6.1.2 Solution:

Period 2:

If the firm did not hire in period 1, then it has to decide about recruitment strategy and about hiring in the beginning of period 2.

The final payoffs depend also on the strategy adopted in the initial period, therefore there are two different games, or knots, in period 2: the choice between S and $\bar{S}$ when S has been implemented in period 1; and the same choice when the first period strategy has been $\bar{S}$.

1) Upper knot (following S)

a) S :

$$S: \begin{array}{ll} \text{G} & \left\langle \begin{array}{ll} \text{h} & E_2(\Pi|G) = \theta_G - w - 2S > -2S \\ \text{nh} & E_2(\Pi|G) = -2S \end{array} \right. \\ \text{B} & \left\langle \begin{array}{ll} \text{h} & E_2(\Pi|B) = \theta_B - w - 2S < -2S \\ \text{nh} & E_2(\Pi|B) = -2S \end{array} \right. \end{array}$$

$$\begin{aligned} E_2(\Pi|S) = & \left[\theta_G - w - 2S\right] \Pr(S = G) + \left[-2S\right] \Pr(S = B) \\ & = \left[\theta_G - w - 2S\right] p + \left[-2S\right](1-p) \\ & = (\theta_G - w)\, p - 2S \end{aligned}$$

When the signal is positive, it is optimal to hire the worker, while do not hire her is the best response to a negative signal.

b) $\bar{S}$:

$$\bar{S}: \left\langle \begin{array}{ll} \text{h} & E_2(\Pi) = p\theta_G + (1-p)\,\theta_B - w - S > -S \\ \text{nh} & E_2(\Pi) = -S \end{array} \right.$$

$$E_2\left(\Pi|\bar{S}\right) = \bar{\theta} - w - S$$

Without screening, any applicant is hired regardless of the signal.

2) Lower knot (following $\bar{S}$)
a) S :

$$S: \begin{array}{cl} \text{G} & \left\langle \begin{array}{ll} \text{h} & E_2(\Pi|G) = \theta_G - w - S > -S \\ \text{nh} & E_2(\Pi|G) = -S \end{array} \right. \\ \text{B} & \left\langle \begin{array}{ll} \text{h} & E_2(\Pi|B) = \theta_B - w - S < -S \\ \text{nh} & E_2(\Pi|B) = -S \end{array} \right. \end{array}$$

$$\begin{aligned} E_2(\Pi|S) = & [\theta_G - w - S]\Pr(S = G) + [-S]\Pr(S = B) \\ & = [\theta_G - w - S]\,p + [-S](1-p) \\ & = (\theta_G - w)\,p - S \end{aligned}$$

When the signal is positive, it is optimal to hire the worker, while do not hire her is the best response to a negative signal.

b) $\bar{S}$:

$$\bar{S}: \left\langle \begin{array}{ll} \text{h} & E_2(\Pi) = \bar{\theta} - w > 0 \\ \text{nh} & E_2(\Pi) = 0 \end{array} \right.$$

$$E_2\left(\Pi|\bar{S}\right) = \bar{\theta} - w$$

Without screening, any applicant is hired regardless of the signal.

In both knots, the optimal choice is defined in the following proposition:

Proposition 7 *At time* 2*, the firm chooses to invest on recruitment only if the excess of cost is lower than the expected loss - due to the possibility of hiring a bad type worker - from strategy* $\bar{S}$*:*

$$S \succ \bar{S} \quad \textit{if} \quad S < (1-p)(w - \theta_B)$$

The expected profit in period 2 is

$$\begin{aligned} \text{if } \bar{S} \text{ in } t_1 \quad &\rightarrow \quad E_2(\Pi) = \max\left\{(\theta_G - w)\,p - S; \bar{\theta} - w\right\} \\ \text{if } S \text{ in } t_1 \quad &\rightarrow \quad E_2(\Pi) = \max\left\{(\theta_G - w)\,p - S; \bar{\theta} - w\right\} - S \end{aligned}$$

Period 1:
1) Assume that $S < (1-p)(w - \theta_B)$
a) S :

$$S: \begin{array}{cl} \text{G} & \left\langle \begin{array}{ll} \text{h} & E(\Pi|G) = 2(\theta_G - w) - S > \\ \text{nh} & E(\Pi|G) = (\theta_G - w)\,p - 2S \end{array} \right. \\ \text{B} & \left\langle \begin{array}{ll} \text{h} & E(\Pi|B) = 2(\theta_B - w) - S < \\ \text{nh} & E(\Pi|B) = (\theta_G - w)\,p - 2S \end{array} \right. \end{array}$$

- G: $2(\theta_G - w) - S > (\theta_G - w)\,p - 2S$
- B: $2(\theta_B - w) - S < (\theta_G - w)\,p - 2S$

Following strategy S, it is optimal to hire applicants who showed signal G, while not to take on individuals with bad signals. In the end, the expected profit from strategy S is:

$$\begin{aligned} E(\Pi|S) &= [2(\theta_G - w) - S]\Pr(S = G) + [(\theta_G - w)p - 2S]\Pr(S = B) \\ &= 2(\theta_G - w)p + (1-p)[(\theta_G - w)p - S] - S \end{aligned}$$

b) $\bar{S}$:

$$\bar{S}: \quad \left\langle \begin{array}{ll} \text{h} & E(\Pi) = 2\left(\bar{\theta} - w\right) \\ \text{nh} & E(\Pi) = (\theta_G - w)p - S \end{array} \right.$$

In this case, the solution is not univocal, but it depends on the value of the parameters involved in the value functions.

$$\begin{array}{l} E\left(\Pi|\bar{S}\right) = \max\left\{2\left(\bar{\theta} - w\right); (\theta_G - w)p - S\right\} \\ \text{if } S < p(\theta_G - w) - 2\left(\bar{\theta} - w\right) \rightarrow \quad E\left(\Pi|\bar{S}\right) = (\theta_G - w)p - S \\ \text{if } S > p(\theta_G - w) - 2\left(\bar{\theta} - w\right) \rightarrow \quad E\left(\Pi|\bar{S}\right) = 2\left(\bar{\theta} - w\right) \end{array}$$

Proof. If $\max\left\{(\theta_G - w)p - S; \bar{\theta} - w\right\} = (\theta_G - w)p - S$, then

$$\begin{array}{ll} & 2\left(\bar{\theta} - w\right) - S > (\theta_G - w)p - S \\ \text{if} & S > p(\theta_G - w) - 2\left(\bar{\theta} - w\right)^{23} \end{array}$$

■

Under the strategy $\bar{S}$, it is not always convenient to hire the applicant in the first period, but it depends on the cost of recruitment. When $S < (\theta_G - w)p - 2\left(\bar{\theta} - w\right)$, it is optimal not to hire in period 1 and to implement S in the second period.

In the end, the best strategy associated to a permanent-contract-vacancy is:

Proposition 8 *Under the assumption $S < (1-p)(w - \theta_B)$, permanent workers are always screened ex-ante:*

$$S + S \succ \bar{S} + \left\{S, \bar{S}\right\} \quad if \quad S < (1-p)(w - \theta_B)$$

Proof. If $(\theta_G - w)p - 2\left(\bar{\theta} - w\right) < S < (1-p)(w - \theta_B)$

$$\begin{array}{ll} \longleftrightarrow & \max\left\{(\theta_G - w)p - S; \bar{\theta} - w\right\} = (\theta_G - w)p - S \\ & \max\left\{2\left(\bar{\theta} - w\right); (\theta_G - w)p - S\right\} = 2\left(\bar{\theta} - w\right) \end{array}$$

$$\begin{array}{ll} & 2(\theta_G - w)p + (1-p)[(\theta_G - w)p - S] - S > 2\left(\bar{\theta} - w\right) \\ \text{if} & 2(w - \theta_B)(1-p) + (1-p)[(\theta_G - w)p - S] - S > 0^{24} \end{array}$$

$\rightarrow$ strategy $S + S \succ \bar{S} + \bar{S}$

$$\text{If } S < (\theta_G - w)\, p - 2\left(\bar{\theta} - w\right) \longleftrightarrow \begin{array}{l} \max\left\{(\theta_G - w)\, p - S; \bar{\theta} - w\right\} = (\theta_G - w)\, p - S \\ \max\left\{2\left(\bar{\theta} - w\right); (\theta_G - w)\, p - S\right\} = (\theta_G - w)\, p - S \end{array}$$

$$\begin{array}{ll} & 2\,(\theta_G - w)\, p + (1-p)\,[(\theta_G - w)\, p - S] - S > (\theta_G - w)\, p - S \\ \text{if} & (1-p)\,[(\theta_G - w)\, p - S] + (\theta_G - w)\, p > 0 \quad \text{always satisfied} \end{array}$$

$\rightarrow$ strategy $S + S \succ \bar{S} + S$ ■

2) Assume $S > (1-p)\,(w - \theta_B)$

a) S :

$$S: \quad \begin{array}{ll} \text{G} & \left\langle \begin{array}{ll} \text{h} & E\,(\Pi|G) = 2\,(\theta_G - w) - S > \\ \text{nh} & E\,(\Pi|G) = \bar{\theta} - w - S \end{array} \right. \\ \text{B} & \left\langle \begin{array}{ll} \text{h} & E\,(\Pi|B) = 2\,(\theta_B - w) - S < \\ \text{nh} & E\,(\Pi|B) = \bar{\theta} - w - S \end{array} \right. \end{array}$$

Following strategy S, it is optimal to hire applicants who showed signal G, while not to take on individuals with bad signals. In the end, the expected profit from strategy S is:

$$\begin{array}{rcl} E\,(\Pi|S) & = & [2\,(\theta_G - w) - S]\,\Pr\,(S = G) + \left[\bar{\theta} - w - S\right]\Pr\,(S = B) \\ & = & 2\,(\theta_G - w)\, p + (1-p)\left(\bar{\theta} - w\right) - S \end{array}$$

b) $\bar{S}$:

$$\bar{S}: \quad \left\langle \begin{array}{ll} \text{h} & E\,(\Pi) = 2\left(\bar{\theta} - w\right) > \\ \text{nh} & E\,(\Pi) = \bar{\theta} - w \end{array} \right.$$

It is always optimal to hire the applicant.

$$E\left(\Pi|\bar{S}\right) = 2\left(\bar{\theta} - w\right)$$

In this case, the best strategy associated to a permanent-contract-vacancy is:

Proposition 9 *Under the assumption $S > (1-p)\,(w - \theta_B)$, permanent workers will be screened ex-ante only if :*

$$S + S \succ \bar{S} + \left\{S, \bar{S}\right\} \quad if \quad S < (1-p)\,[(w - \theta_B) + p\,(\theta_G - \theta_B)]$$

Proof. $S \succ \bar{S} \longleftrightarrow 2\,(\theta_G - w)\, p + (1-p) \max\left\{(\theta_G - w)\, p - S; \bar{\theta} - w\right\} - S >$
$\max\left\{2\left(\bar{\theta} - w\right); (\theta_G - w)\, p - S\right\}$

$$\text{If } S > (1-p)\,(w - \theta_B) \longleftrightarrow \begin{array}{l} \max\left\{(\theta_G - w)\, p - S; \bar{\theta} - w\right\} = \bar{\theta} - w \\ \max\left\{2\left(\bar{\theta} - w\right); (\theta_G - w)\, p - S\right\} = 2\left(\bar{\theta} - w\right) \end{array}$$

$$\begin{array}{ll} & 2\,(\theta_G - w)\, p + (1-p)\left(\bar{\theta} - w\right) - S > 2\left(\bar{\theta} - w\right) \\ \text{if} & S < (1-p)\,[(w - \theta_B) + p\,(\theta_G - \theta_B)] \end{array}$$

$\rightarrow$ strategy $S + \bar{S} \succ \bar{S} + \bar{S}$ ■

The solution of the game is summarized in Picture 3.

Proposition 10 *Permanent workers will be screened only if :*

$$S \succ \bar{S} \quad if \quad S < (1-p)\left[(w-\theta_B) + p\left(\theta_G - \theta_B\right)\right]$$

In particular:

$$\begin{array}{lll} if\ S < (1-p)\left(w-\theta_B\right) & \rightarrow & S+S \succ \bar{S}+\left\{S,\bar{S}\right\} \\ if\ (..) < S < (1-p)\left[(w-\theta_B) + p\left(\theta_G-\theta_B\right)\right] & \rightarrow & S+\bar{S} \succ \bar{S}+\bar{S} \\ if\ S > (1-p)\left[(w-\theta_B) + p\left(\theta_G-\theta_B\right)\right] & \rightarrow & \bar{S}+\bar{S} \succ S+\bar{S} \end{array}$$

6.2 Temporary Contract:

6.2.1 Timing:

Consider the case of a firm dealing with a vacancy for a temporary worker. Now monitoring is a sensible alternative, given that temporary contracts last only one year, then they can be either renewed or terminated at no cost. The firm can choose between three strategies: S, screening ex-ante, and $\bar{S}+\bar{M}$, no screening ex-ante nor monitoring, and $\bar{S}+M$, no screening ex-ante followed by monitoring. While the strategy $S+M$ is never convenient: if S is performed at the beginning of period 1, then the resulting signal will reveal the type of the applicant and there won't be any need for monitoring the worker.

If the applicant is hired and monitoring is performed, the signal is received at the end of period 1. Then, the firm decides whether to continue the relationship with the worker or not. Given the insecurity of the job, the worker has incentive to quit and to look for a better position. Employees quit the job with probability $1-\alpha$

A decision is taken in period 2 only if no worker has been hired in period 1, or if the employee has been fired or quitted.

See Picture 2 for the detailed timing of the game.

6.2.2 Solution:

Period 2:

The problem is similar to the game solved for the permanent contract in period 2, except that there are four more knots. It is easy to verify that the condition under which S is chosen as best strategy is:

Proposition 11 *At time 2, the firm chooses to invest on recruitment only if the excess of cost is lower than the expected loss - due to the possibility of hiring a bad type worker - from strategy $\bar{S}$:*

$$S \succ \bar{S} \quad if \quad S < (1-p)\left(w-\theta_B\right)$$

Period 1 - end:

If the firm hired in the beginning of period 1 and performed monitoring, then a signal arrives at the end of period 1 and the firm will be able to disentangle the type of the worker. Given this piece of information, the employer decides whether to continue the employment relationship or not

1) Assume $S < (1-p)(w-\theta_B)$

a) M :

$$M: \begin{array}{ll} \text{G} & \left\langle \begin{array}{ll} \text{c} & E(\Pi|G) = \alpha[2(\theta_G - w)] + (1-\alpha)[\theta_G - w + p(\theta_G - w) - S] - M > \\ \text{d} & E(\Pi|G) = (1+p)(\theta_G - w) - M - S \end{array} \right. \\ \text{B} & \left\langle \begin{array}{ll} \text{c} & E(\Pi|B) = \alpha[2(\theta_B - w)] + (1-\alpha)[\theta_B - w + p(\theta_G - w) - S] - M < \\ \text{d} & E(\Pi|B) = \theta_B - w - M - S + p(\theta_G - w) \end{array} \right. \end{array}$$

$$E(\Pi|M) = p\alpha(\theta_G - w) + (1 - p\alpha)[(\theta_G - w)p - S] + \bar{\theta} - w - M$$

The firm continues the employment relationship only with those workers which showed good signal.

b) $\bar{M}$

$$E\left(\Pi|\bar{M}\right) = (1+\alpha)\left(\bar{\theta} - w\right) + (1-\alpha)[(\theta_G - w)p - S]$$

If monitoring is not performed, no decision is taken in the end of period 1 and the firm always renew the contract if the worker does not quit.

1) Assume $S > (1-p)(w-\theta_B)$

a) M

$$M: \begin{array}{ll} \text{G} & \left\langle \begin{array}{ll} \text{c} & E(\Pi|G) = \alpha[2(\theta_G - w)] + (1-\alpha)\left[\theta_G - w + \bar{\theta} - w\right] - M > \\ \text{d} & E(\Pi|G) = \theta_G - w - M + \bar{\theta} - w \end{array} \right. \\ \text{B} & \left\langle \begin{array}{ll} \text{c} & E(\Pi|B) = \alpha[2(\theta_B - w)] + (1-\alpha)\left[\theta_B - w + \bar{\theta} - w\right] - M < \\ \text{d} & E(\Pi|B) = \theta_B - w - M + \bar{\theta} - w \end{array} \right. \end{array}$$

$$E(\Pi|M) = p\alpha(1-p)(\theta_G - \theta_B) + 2\left(\bar{\theta} - w\right) - M$$

The firm continues the employment relationship only with those workers which showed good signal.

b) $\bar{M}$:

$$E\left(\Pi|\bar{M}\right) = 2\left(\bar{\theta} - w\right)$$

If monitoring is not performed, no decision is taken in the end of period 1 and the firm always renew the contract if the worker does not quit.

Period 1 - beginning:

In the beginning of period 1, the choice is between 3 strategies: S, $\bar{S} + \bar{M}$ and $\bar{S} + M$.

1) Assume $S < (1-p)(w-\theta_B)$

a) S :

$$S: \quad \begin{array}{ll} \text{G} & \left\langle \begin{array}{ll} \text{h} & E(\Pi|G) = (1+\alpha)(\theta_G - w) + (1-\alpha)[(\theta_G - w)p - S] - S > \\ \text{nh} & E(\Pi|G) = (\theta_G - w)p - 2S \end{array} \right. \\ \text{B} & \left\langle \begin{array}{ll} \text{h} & E(\Pi|B) = (1+\alpha)(\theta_B - w) + (1-\alpha)[(\theta_G - w)p - S] - S < \\ \text{nh} & E(\Pi|B) = (\theta_G - w)p - 2S \end{array} \right. \end{array}$$

$$E(\Pi|S) = (1+\alpha)(\theta_G - w)p + (1-p\alpha)[(\theta_G - w)p - S] - S$$

b) $\bar{S} + \bar{M}$:

$$\bar{S} + \bar{M}: \quad \left\langle \begin{array}{ll} \text{h} & E(\Pi) = (1+\alpha)\left(\bar{\theta} - w\right) + (1-\alpha)[(\theta_G - w)p - S] \\ \text{nh} & E(\Pi) = (\theta_G - w)p - S \end{array} \right.$$

$$E\left(\Pi|\bar{S}\right) = (\theta_G - w)p - S + \max\left\{(1+\alpha)\left(\bar{\theta} - w\right) - \alpha[(\theta_G - w)p - S]; 0\right\}$$

$$\begin{array}{lll} \text{if } S < \frac{(1+\alpha-\alpha p)(w-\theta_B)+p(\theta_B-\theta_G)}{\alpha} & \rightarrow & E\left(\Pi|\bar{S}\right) = (\theta_G - w)p - S \\ \text{if } \frac{(...)}{\alpha} < S < (1-p)(w-\theta_B) & \rightarrow & E\left(\Pi|\bar{S}\right) = (1+\alpha)\left(\bar{\theta} - w\right) + \\ & & + (1-\alpha)[(\theta_G - w)p - S] \end{array}$$

When the cost of recruitment is lower than $\frac{(1+\alpha-\alpha p)(w-\theta_B)+p(\theta_B-\theta_G)}{\alpha}$, the optimal decision is not to hire in period 1 and to invest in recruitment in the second period. Otherwise, it is convenient to hire the applicant.

c) $\bar{S} + M$:

$$\bar{S}+M: \quad \left\langle \begin{array}{ll} \text{h} & E(\Pi) = \left(\bar{\theta} - w\right) + p\alpha(\theta_G - w) + (1-p\alpha)[(\theta_G - w)p - S] - M > \\ \text{nh} & E(\Pi) = (\theta_G - w)p - S \end{array} \right.$$

$$E\left(\Pi|\bar{S} + M\right) = (\theta_G - w)p - S + \max\left\{\left(\bar{\theta} - w\right) + p\alpha(\theta_G - w) - p\alpha[(\theta_G - w)p - S] - M; 0\right\}$$

The employer hire the applicant only if the cost of monitoring is under a certain threshold:

$$M < \left(\bar{\theta} - w\right) + (1-p)p\alpha(\theta_G - w) + p\alpha S$$

In this simple game, screening ex-ante and screening on-the-job both give a true signal. Therefore it is reasonable to assume that they cost the same: $M = S$. Furthermore, this assumption allow to study the choice between recruitment and monitoring in a framework in which the only difference between the two strategies is in the mechanism through which they provide the signal, but there

is no a-priori convenience of one method wih respect to the other. Then, the condition under which it is optimal to hire the applicant becomes:

$$M = S < \frac{\left(\bar{\theta} - w\right) + (1-p)\, p\alpha\, (\theta_G - w)}{1 - p\alpha}$$

Under the hypothesis $S < (1-p)\,(w - \theta_B)$, this condition is always met. The expected profit from strategy $\bar{S} + M$ is:

$$E\left(\Pi|\bar{S} + M\right) = \left(\bar{\theta} - w\right) - (2 - p\alpha)\, S + p\,(\theta_G - w)\,[1 + \alpha\,(1-p)]$$

In the end, the optimal strategy is:

Proposition 12 *Under the assumption $S < (1-p)\,(w - \theta_B)$, temporary workers are always screened ex-ante:*

$$S + S \succ \bar{S} + \left\{S, \bar{S}\right\} \quad if \quad S < (1-p)\,(w - \theta_B)$$

Note that, in the interval $S < (1-p)\,(w - \theta_B)$, the optimal strategy for both type of contracts is S. Which means that, when it is optimal to invest in recruitment in the second period, it has to be optimal in the first period as well. It is never convenient to postpone the cost of screening ex-ante.

2) Assume $S > (1-p)\,(w - \theta_B)$

a) S :

$$S: \begin{array}{ll} \text{G} & \left\langle \begin{array}{ll} \text{h} & E\,(\Pi|G) = (1+\alpha)\,(\theta_G - w) + (1-\alpha)\left(\bar{\theta} - w\right) - S > \\ \text{nh} & E\,(\Pi|G) = \bar{\theta} - w - S \end{array} \right. \\ \text{B} & \left\langle \begin{array}{ll} \text{h} & E\,(\Pi|B) = (1+\alpha)\,(\theta_B - w) + (1-\alpha)\left(\bar{\theta} - w\right) - S < \\ \text{nh} & E\,(\Pi|B) = \bar{\theta} - w - S \end{array} \right. \end{array}$$

$$E\,(\Pi|S) = (1+\alpha)\,(\theta_G - w)\, p + (1 - p\alpha)\left(\bar{\theta} - w\right) - S$$

b) $\bar{S} + \bar{M}$:

$$\bar{S} + \bar{M}: \quad \left\langle \begin{array}{ll} \text{h} & E\,(\Pi) = 2\left(\bar{\theta} - w\right) > \\ \text{nh} & E\,(\Pi) = \bar{\theta} - w \end{array} \right.$$

It is always optimal to hire the applicant, obtaining the following expected profit:

$$E\left(\Pi|\bar{S}\right) = 2\left(\bar{\theta} - w\right)$$

c) $\bar{S} + M$:

$$\bar{S}{+}M: \quad \left\langle \begin{array}{ll} \text{h} & E\,(\Pi) = \left(\bar{\theta} - w\right) + p\alpha\,(\theta_G - w) + (1 - p\alpha)\left(\bar{\theta} - w\right) - M > \\ \text{nh} & E\,(\Pi) = \bar{\theta} - w \end{array} \right.$$

$$E\left(\Pi|\bar{S}+M\right)=\bar{\theta}-w+\max\left\{\left(\bar{\theta}-w\right)+p\alpha\left(\theta_G-\bar{\theta}\right)-M;0\right\}$$

The employer hire the applicant only if the cost of monitoring is under a certain threshold:

$$M<\left(\bar{\theta}-w\right)+p\alpha\left(\theta_G-\bar{\theta}\right)^{25}$$

The expected profit from strategy $\bar{S}+M$ is:

$$E\left(\Pi|\bar{S}+M\right)=\bar{\theta}-w+\max\left\{\left(\bar{\theta}-w\right)+p\alpha\left(\theta_G-\bar{\theta}\right)-M;0\right\}$$

$$\begin{array}{lll}\text{if } M & < & \left(\bar{\theta}-w\right)+p\alpha\left(\theta_G-\bar{\theta}\right)\rightarrow E\left(\Pi|\bar{S}+M\right)=2\left(\bar{\theta}-w\right)+p\alpha\left(\theta_G-\bar{\theta}\right)-M\\ \text{if } M & > & \left(\bar{\theta}-w\right)+p\alpha\left(\theta_G-\bar{\theta}\right)\rightarrow E\left(\Pi|\bar{S}+M\right)=\bar{\theta}-w\end{array}$$

In the end, the optimal strategy is:

Proposition 13 *Under the assumption $S>(1-p)(w-\theta_B)$, temporary workers will be screened ex-ante only if :*

$$S+\bar{S}\succ\bar{S}+\bar{M}\quad if\quad S<(1-p)\left[(w-\theta_B)+\alpha p\left(\theta_G-\theta_B\right)\right]$$

The solution of the game is showed in Picture 4.

Proposition 14 *Temporary workers will be screened only if:*

$$\begin{array}{ll}S\succ\left\{\bar{S}+M;\bar{S}\right\} & if\quad S<(1-p)(w-\theta_B)\\ & or\ \ S<(1-p)\left[w-\theta_B+p\alpha\left(\theta_G-\theta_B\right)\right]\\ & and\ \ (1-p)\left[\theta_B-w+p\theta_G(1+\alpha)\right]<0\end{array}$$

In particular:

$$\begin{array}{lll}if\ S<(1-p)(w-\theta_B) & \rightarrow & S\succ\left\{\bar{S}+M;\bar{S}\right\}\\ if\ (..)<S<p\alpha\left(\theta_G-\bar{\theta}\right) & \rightarrow & \bar{S}+M\succ\left\{\bar{S};S\right\}\\ and\ \theta_B-w+p\theta_G(1+\alpha)>0 & & \\ if\ (..)<S<(1-p)\left[(w-\theta_B)+p\alpha\left(\theta_G-\theta_B\right)\right] & \rightarrow & S\succ\left\{\bar{S};\bar{S}+M\right\}\\ if\ S>(1-p)\left[(w-\theta_B)+p\alpha\left(\theta_G-\theta_B\right)\right] & \rightarrow & \bar{S}\succ\left\{\bar{S};S\right\}\end{array}$$

[25] Given that I assumed $M=S$, I've to check that the condition $M<\bar{\theta}-w+p\alpha\left(\theta_G-\bar{\theta}\right)$ is coherent with $S>(1-p)(w-\theta_B)$. The necessary condition is:

$$(1-p)(w-\theta_B)<\bar{\theta}-w+p\alpha\left(\theta_G-\bar{\theta}\right)$$

and it is always verified.

6.2.3 Comparison

Depending on the values of the parameters involved, the optimal recruitment strategy could be either S or $\bar{S}$ for both contracts; or it could imply different recruitment expenditure according to the lenght of the employment relationship. There is a certain set of parameters' values such that the latter equilibrium arises:

Proposition 15 *The optimal recruitment strategy is:*
- $\bar{S}$ *if temporary worker*
- S *if permanent worker*
if the following condition holds:

$$(1-p)\left[(w-\theta_B)+p\alpha\left(\theta_G-\theta_B\right)\right] < S < (1-p)\left[(w-\theta_B)+p\left(\theta_G-\theta_B\right)\right]$$

In particular, the lower is α, the wider is the set of parameters which involve the above-mentioned varied strategy. It will be optimal to invest also on recruiting atypical workers when the contract is likely to be renewed, and the expected duration of the employment relationship is long enough to amortize the cost.

The possibility of performing monitoring on temporary contracts, give rise to another varied strategy:

Proposition 16 *The optimal screening strategy is:*
- $\bar{S}+M$ *if temporary worker*
- S *if permanent worker*
if the following conditions holds:

$$\begin{aligned}&(1-p)\left(w-\theta_B\right) < S < p\alpha\left(\theta_G-\bar{\theta}\right)\\&\theta_B - w + p\theta_G\left(1+\alpha\right) > 0\end{aligned}$$

There exists a set of parameters such that it is convenient to monitor fixed-term workers, while screening ex-ante the permanent ones. In particular, ceteris paribus, the higher is α, the wider is that interval: when the expected duration of the contract, $(1+\alpha p)$, is longer, it is more convenient to spend in monitoring the temporary hires. Whereas, if the quitting rate is high, then it is not sensible to monitor a worker which could not be renewable next period.

Figure 1: Permanent contract vacancy - Timing

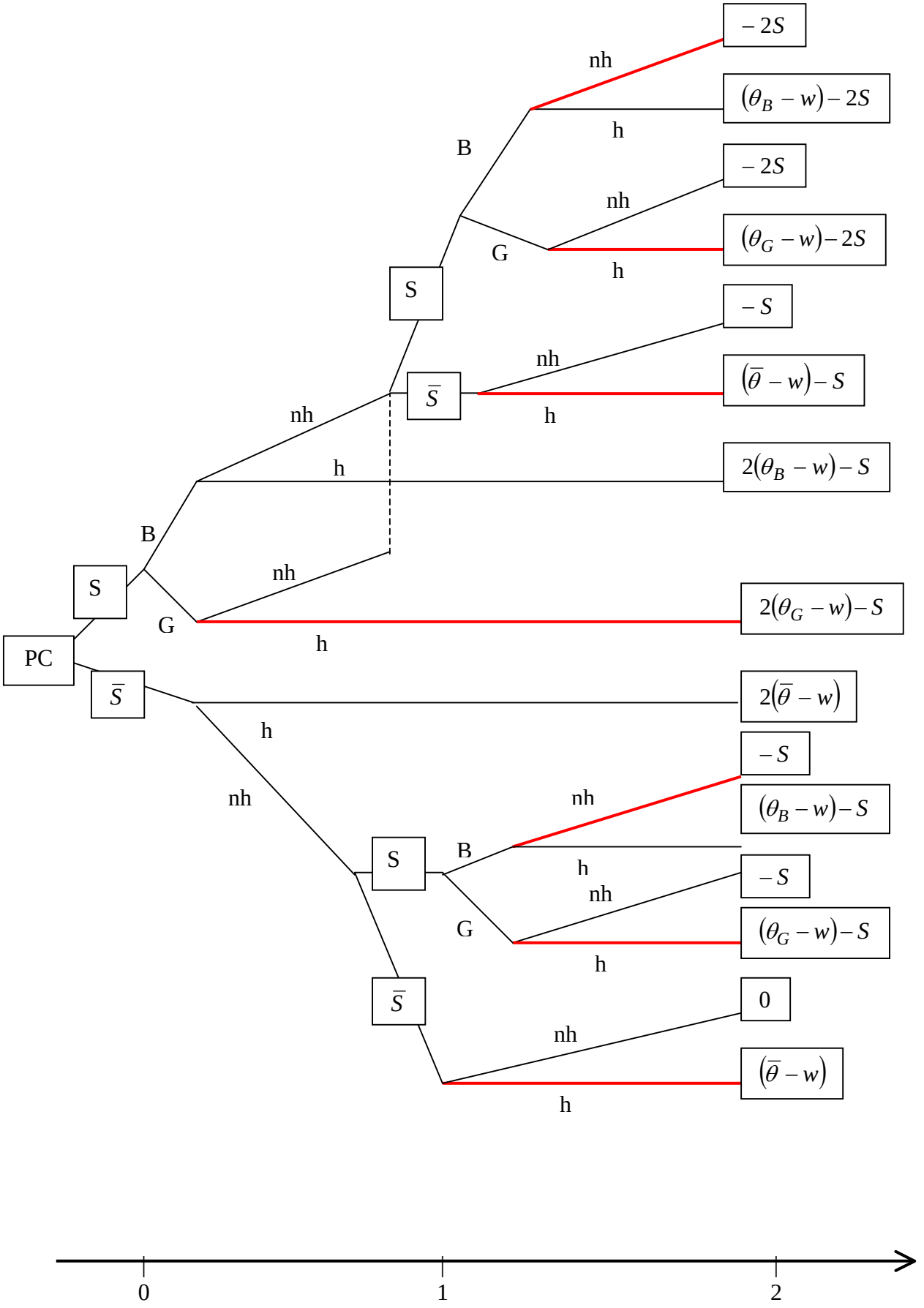

Figure 2: Temporary contract vacancy – Timing

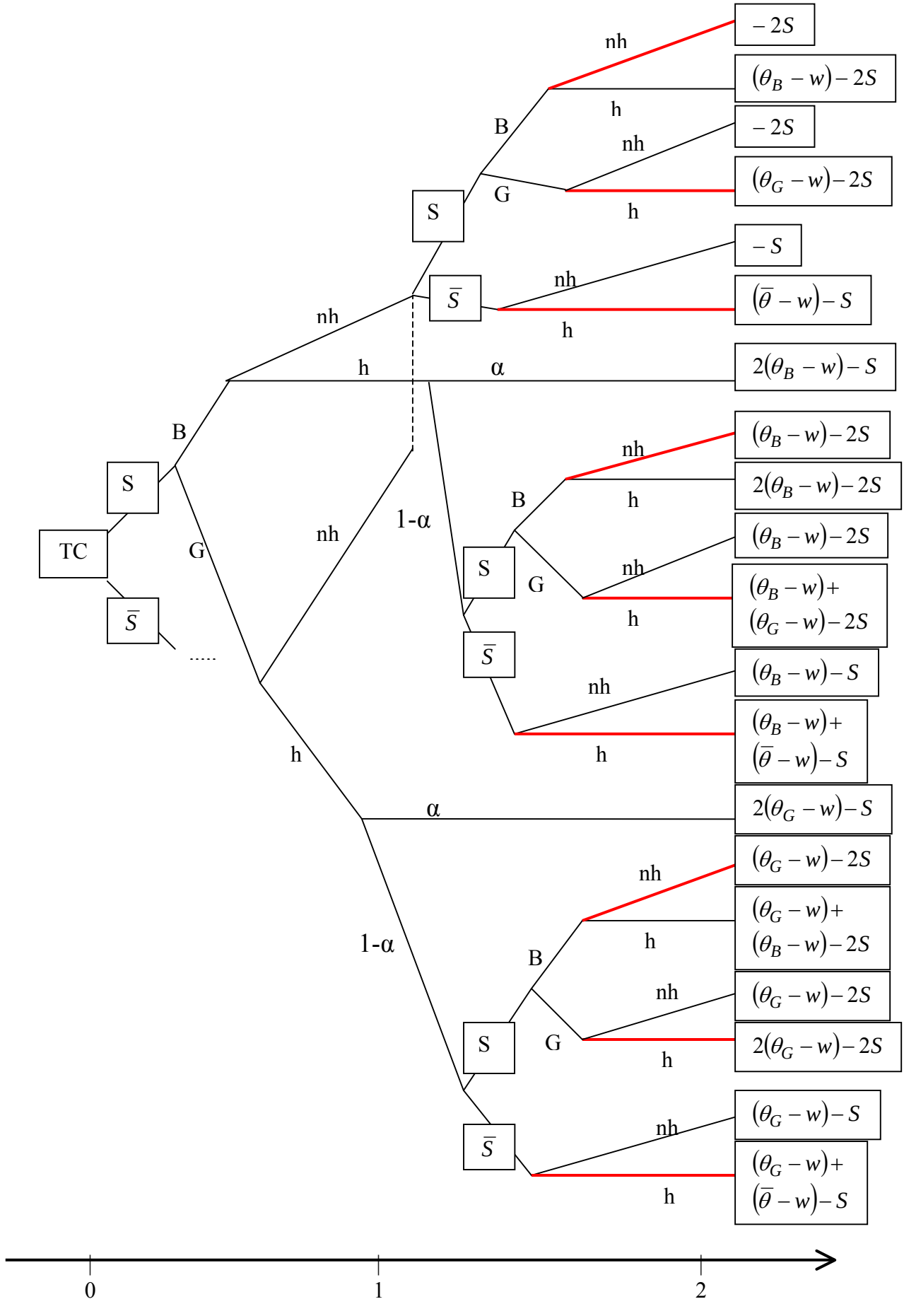

Figure 2: Temporary contract vacancy – Timing (continue)

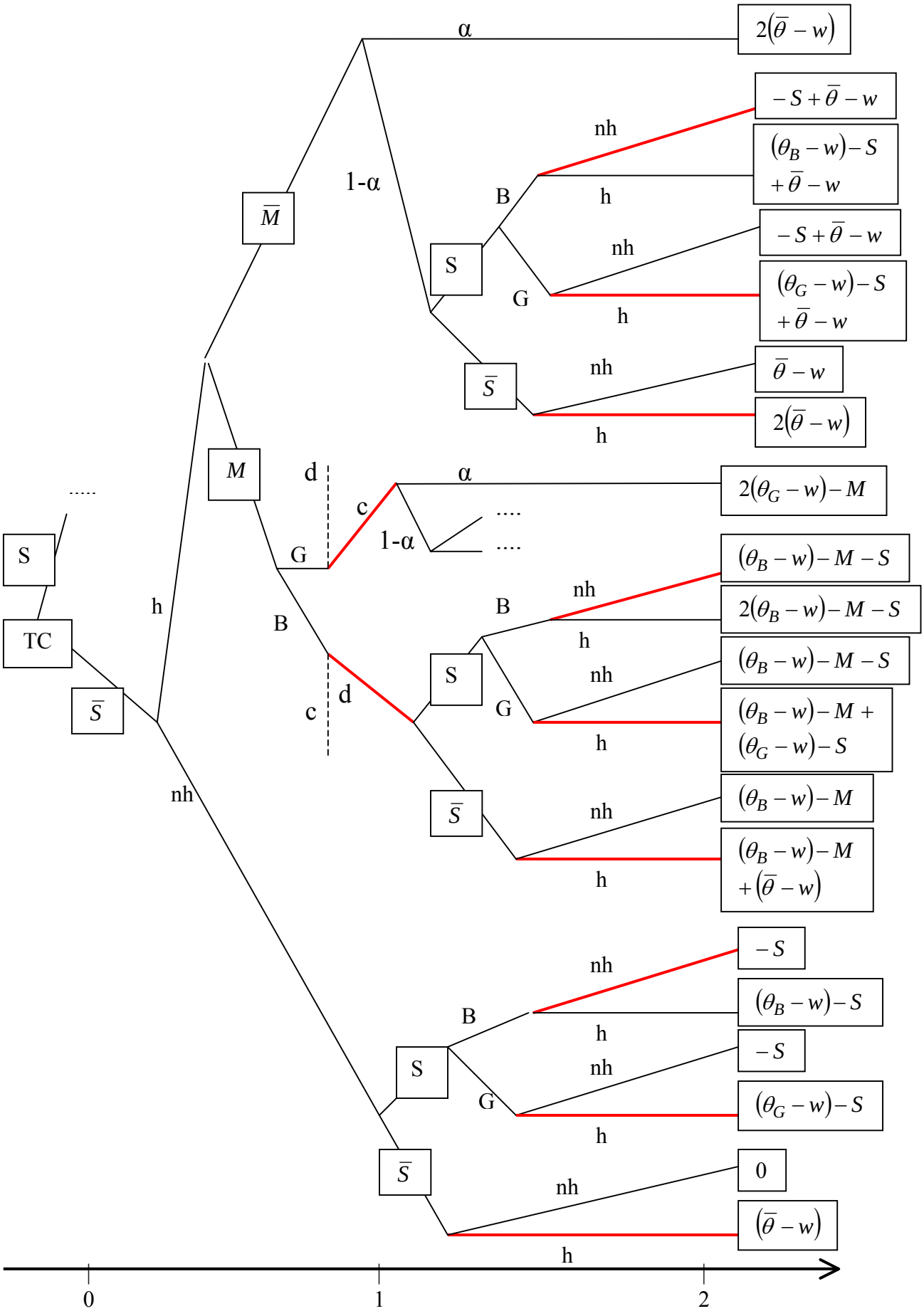

Figure 3: Permanent contract vacancy – Solution

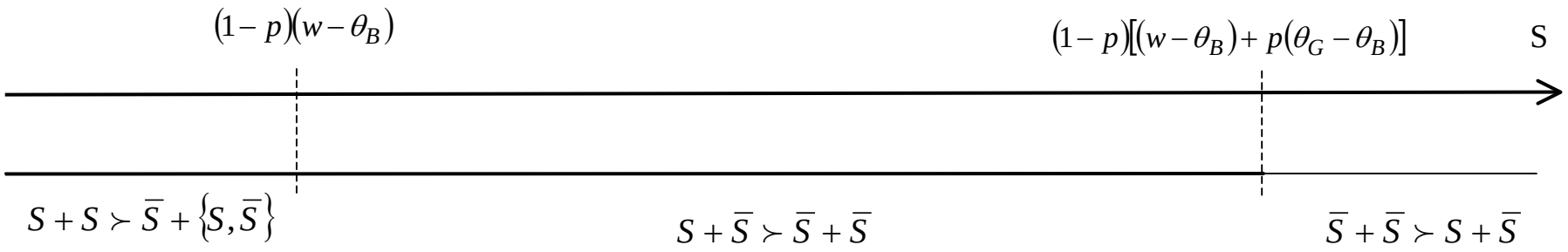

Figure 4: Temporary contract vacancy – Solution & Comparison

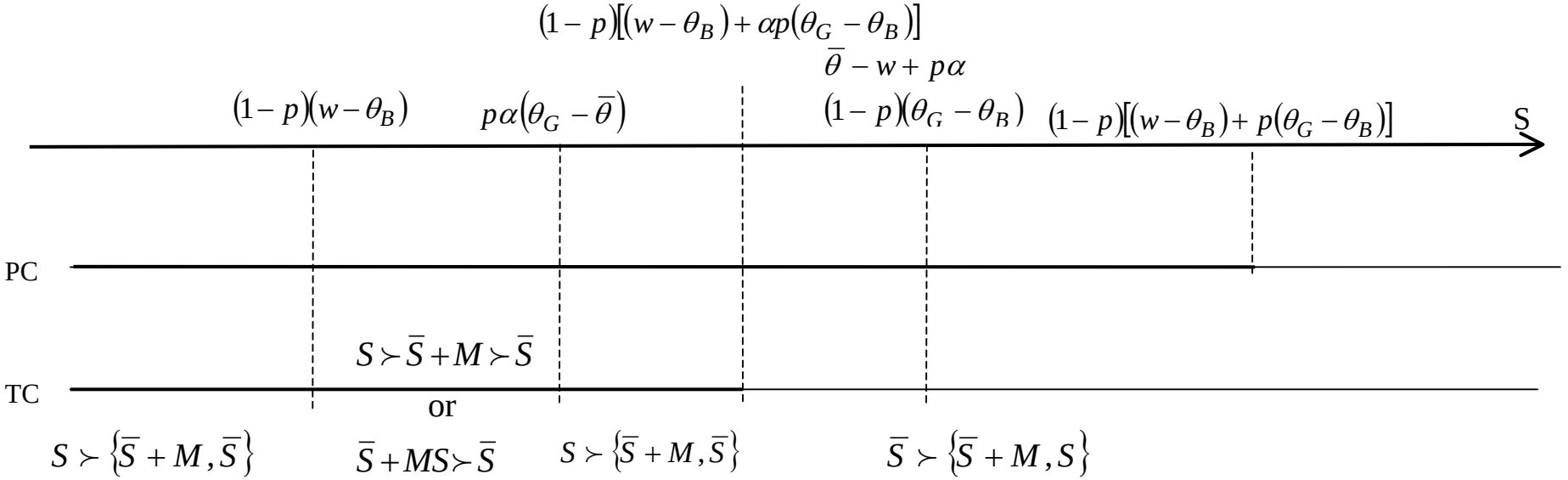

Figure 4: Recruitment channels valuation by job qualification: speed

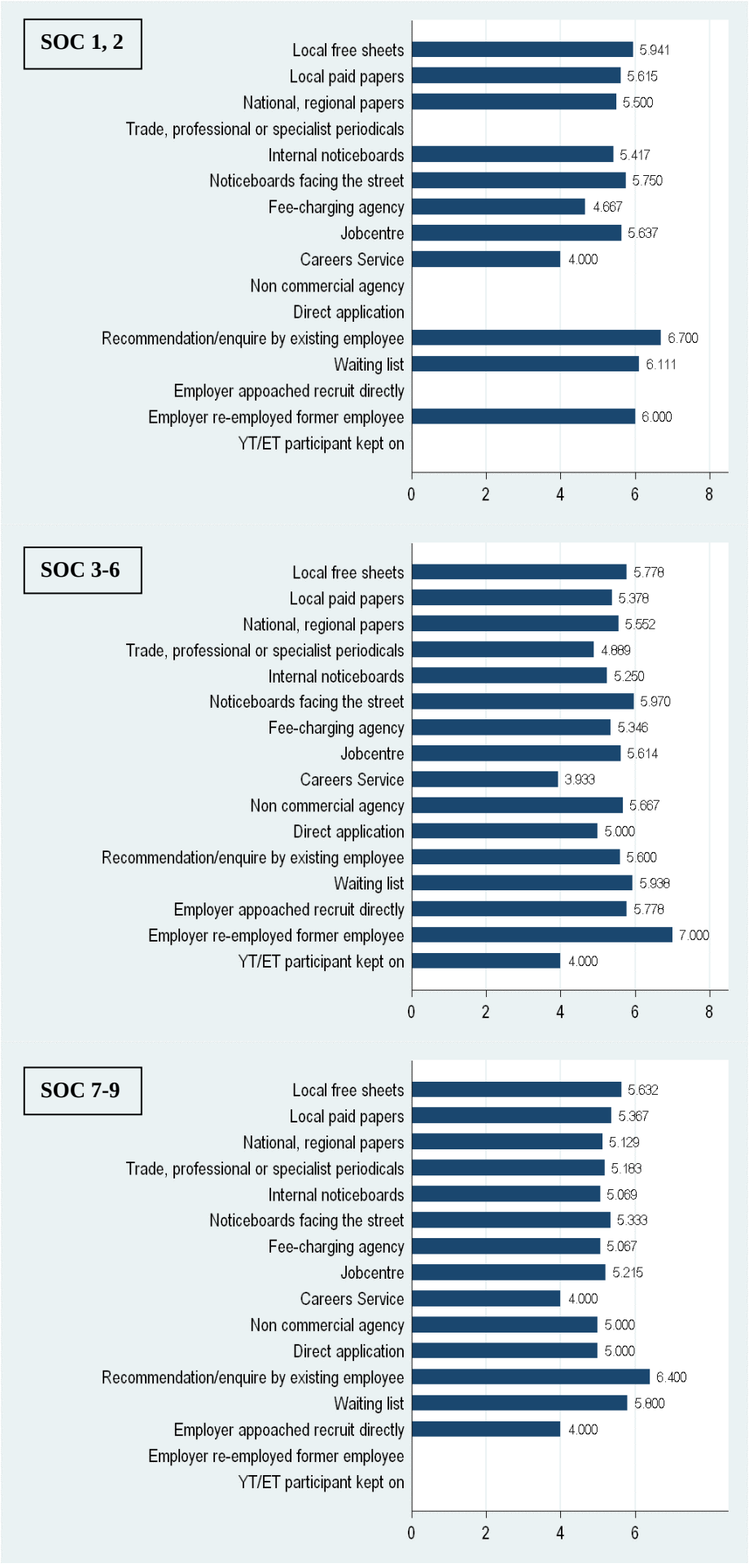

Figure 5: Recruitment channels valuation by job qualification: cost

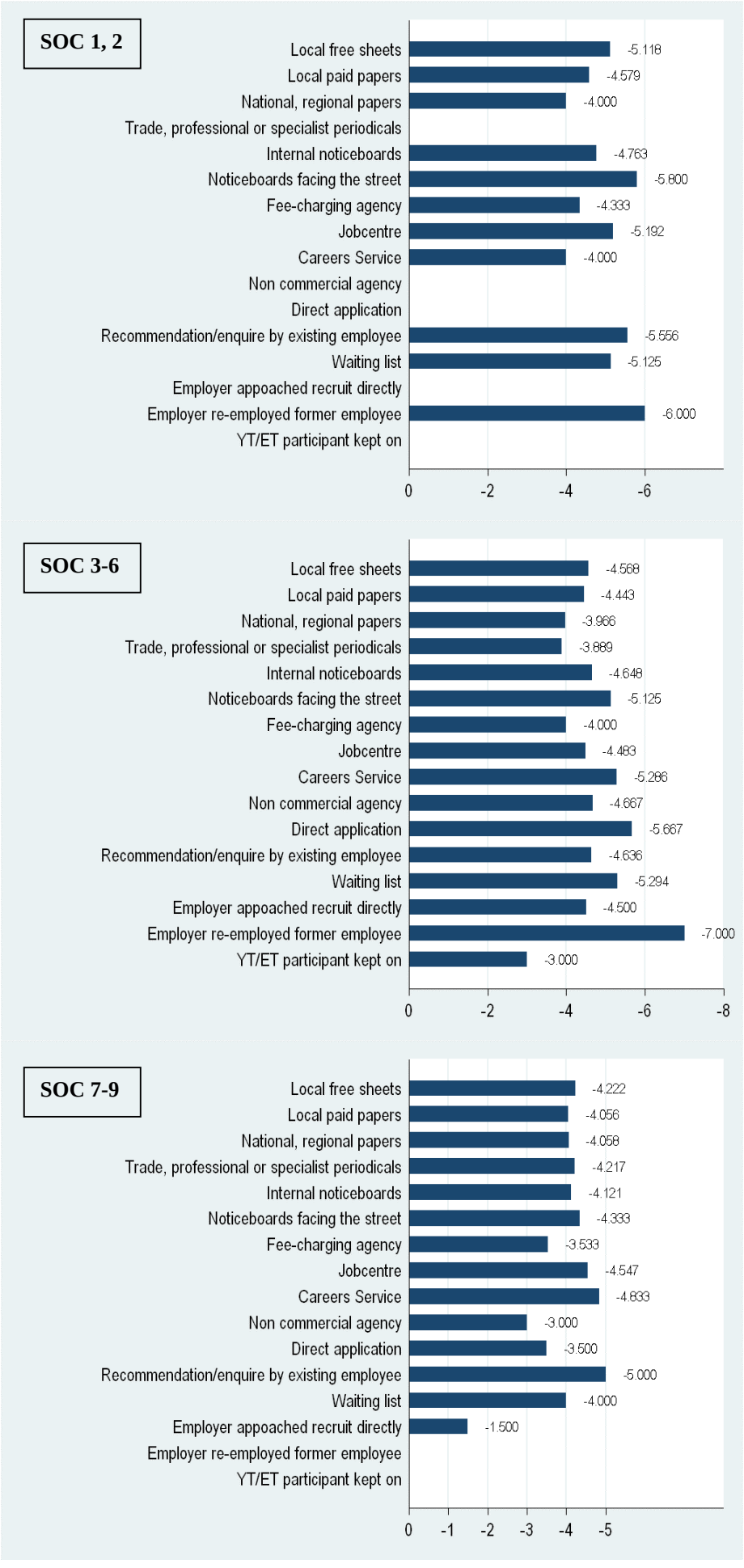

Table 1: Dynamic of the share of temporary employment

	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
EU-15*	9.0	10.2	10.4	10.9	10.6	11.0	11.5	11.8	12.2	12.8	13.2	13.4
Belgium	6.9	5.3	5.1	4.9	5.1	5.1	5.3	5.9	6.3	7.8	10.3	9.0
Denmark	12.3	10.8	11.9	11.0	10.7	12.0	12.1	11.2	11.1	10.1	10.2	10.2
Germany*	10.0	10.5	10.1	10.5	10.3	10.3	10.4	11.1	11.7	12.3	13.1	12.7
Greece	21.1	16.5	14.7	10.2	10.4	10.3	10.2	11.0	10.9	13.0	13.0[(2)]	13.1
Spain	15.6	29.8	32.2	33.5	32.2	33.7	35.0	33.6	33.6	32.9	32.7	32.1
France	4.7	10.5	10.2	10.5	10.9	11.0	12.3	12.6	13.1	13.9	14.0	15.0
Ireland	7.3	8.5	8.3	8.7	9.4	9.5	10.2	9.2	9.4	9.4[(1)]	9.4[(1)]	4.6
Italy	4.8	5.2	5.4	7.5	6.0	7.3	7.2	7.5	8.2	8.6	9.8	10.1
Luxembourg	4.7	3.4	3.3	2.9	3.0	2.9	..	2.6	2.1	2.9	3.4	3.4
Netherlands	7.5	7.6	7.7	9.7	10.0	10.9	10.9	12.0	11.4	12.7	12.0	14.0
Austria	..	..	..	..	..	..	6.0	8.0	7.8	7.8	7.5	7.9
Portugal	14.4	18.3	16.4	11.0	9.8	9.4	10.0	10.6	12.2	17.3	18.6	20.4
Finland	10.5	11.5	12.0	13.1	12.7	12.9	16.5	17.3	17.1	17.7	18.2	17.7
Sweden	11.9	10.0	9.8	10.5	11.5	11.5	12.5	11.8	12.1	12.9	13.9	14.7
UK	7.0	5.2	5.3	5.5	5.9	6.5	7.0	7.1	7.4	7.1	6.8	6.7
US**	..	0.9	0.9	1.0	1.2	1.5	1.6	1.7	1.8	1.9	1.9	1.9

Source: European Countries: European Commission. Employment in Europe (1985-1996) and Labour Force Survey (1997-2000).
US: American Staffing Association and Bureau of Labor Statistics.

* Since 1991, data on Germany and EU-15 include the new German Länder

** Data on US regard only temporary help agency employment

(1) Ireland reports the 1997 value for 1998 and 1999.

(2) Greece reports the 1998 value for 1999.

Table 2: Descriptive statistics (weighted values)

Contract type:	**Full sample**	**Sample**
Temporary	22.74	22.20
Casual	1.90	0.40
Fixed-term	10.02	4.81
Permanent	62.78	70.05
Provisional	2.09	2.52
Self-employed	0.06	-
Don't know/Not answered	0.41	-
Sample size (engagements)	*20,339*	*3,416*
Establishments' characteristics:		
SIC:		
1. Energy and water supply	0.42	0.56
2. Metals, minerals, etc.	1.73	1.82
3. Metal goods, engineering, etc.	5.61	6.43
4. Other manufacturing	5.94	7.32
5. Construction	3.08	2.09
6. Distribution, catering, etc.	32.66	35.77
7. Transport and communication	4.64	4.09
8. Banking, insurance, etc.	16.99	23.71
9. Other services	28.92	18.78
Sample size (establishment)	*6,271*	*1,291*
Size:		
3 - 10	40.44	38.30
11 - 24	21.37	18.80
25 - 49	15.73	13.83
50 - 99	9.31	12.00
100 - 199	6.40	7.68
200 - 499	4.47	6.72
500 - 999	1.12	1.68
1000 - 1999	0.62	0.64
2000 or more	0.54	0.35
Sample size (establishment)	*6,284*	*1,291*
Region:		
London/SE	30.74	32.60
South West	9.08	8.21
West Mids	9.14	11.32
E Mids/East	11.37	12.12
York/Humber	8.85	9.18
North West	12.15	11.47
North	4.31	3.10
Wales	5.11	3.72
Scotland	9.24	8.27

Sample size (establishment)	*6,284*	*1,291*
Job's characteristics:		
SOC:		
Routine, unskilled	15.59	10.52
Operatives & assembly	18.80	28.62
Sales	6.11	12,45
Protective and Personal service	6.78	6.07
Craft & Skilled Service	6.34	6.39
Clerical & Secretarial	18.77	16.98
Professional assoc & technical	10.49	6.35
Professional	13.44	9.07
Management & administration	3.69	3.54
Sample size	*20,339*	*3,416*
Supervision:		
Yes	84.09	88.34
No	15.91	11.66
Sample size	20,208	3.416
Workers' characteristics:		
Gender:		
Male	45.77	53.03
Female	54.23	46.97
Sample size	*20,292*	*3,416*
Age:		
16-18	5.55	6.48
19-24	26.93	31.90
25-34	39.73	38.40
35-44	19.03	17.67
45-54	7.01	4.87
55 or over	1.74	0.67
Sample size	*19,705*	*3,416*
Employment status:		
Sub-contract/agency employee working at this establishment	2.80	1.99
Employee at a different establishment of this organization	4.72	3.94
Working for another employer	36.41	46.95
Unemployed	31.93	23.05
In full time education	11.00	19.90
Not in the labour market	5.56	2.75
Other	2.25	1.43
Don't know / Not stated	5.33	-
Sample size	*20,339*	*3,416*

Table 3: Regression - channel cost

	OLS			FE		
	(1)	(2)	(3)	(4)	(5)	(6)
Contract	-0.132			-0.026		
	(7.94)***			(2.52)**		
conxsoc1		-0.093			0.124	
		(1.78)*			(5.23)***	
conxsoc2		-0.182			-0.283	
		(7.46)***			(8.86)***	
conxsoc3		-0.070			-0.241	
		(1.52)			(5.44)***	
conxsoc4		0.172			0.074	
		(2.81)***			(2.72)***	
conxsoc5		-0.941			-0.299	
		(12.47)***			(5.45)***	
conxsoc6		-0.067			-0.022	
		(1.98)**			(1.15)	
conxsoc7		-0.017			-0.025	
		(0.21)			(1.24)	
conxsoc8		0.110			0.021	
		(1.08)			(1.15)	
conxsoc9		-0.008			-0.109	
		(0.04)			(1.96)**	
conxsic1			0.040			0.416
			(0.42)			(4.19)***
conxsic2			0.231			0.086
			(3.73)***			(1.12)
conxsic3			-0.299			-0.407
			(9.24)***			(11.83)***
conxsic4			-0.256			-0.285
			(7.54)***			(4.33)***
conxsic5			-0.111			-0.007
			(0.51)			(0.04)
conxsic6			-0.245			-0.182
			(6.70)***			(4.57)***
conxsic7			0.007			-0.269
			(0.11)			(2.50)**
conxsic8			0.021			0.016
			(0.64)			(0.46)
conxsic9			0.061			0.024
			(0.94)			(2.05)**
Controls:						
Workers' character.	yes	yes	yes	yes	yes	yes
Firms' character.	yes	yes	yes	no	no	no
Jobs' character.	yes	yes	yes	yes	yes	yes
Obs	3053	3053	3053	6994	6994	6994
Adjusted R-squared	0.60	0.62	0.62	0.86	0.87	0.87

Absolute value of t statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 4: Regression - channel speed

	OLS			FE		
	(1)	(2)	(3)	(4)	(5)	(6)
Contract	0.163			0.011		
	(11.07)***			(1.49)		
conxsoc1		0.254			-0.003	
		(5.35)***			(0.19)	
conxsoc2		0.137			0.116	
		(6.21)***			(4.83)***	
conxsoc3		0.206			0.095	
		(4.97)***			(2.85)***	
conxsoc4		-0.007			0.019	
		(0.12)			(0.91)	
conxsoc5		0.314			0.139	
		(4.59)***			(3.37)***	
conxsoc6		0.217			0.064	
		(7.10)***			(4.52)***	
conxsoc7		0.058			-0.043	
		(0.76)			(2.79)***	
conxsoc8		0.067			-0.040	
		(0.72)			(2.96)***	
conxsoc9		-0.459			-0.048	
		(2.49)**			(1.15)	
conxsic1			0.282			1.037
			(3.30)***			(14.16)***
conxsic2			-0.334			0.137
			(6.08)***			(2.42)**
conxsic3			0.127			0.082
			(4.41)***			(3.24)***
conxsic4			0.286			0.267
			(9.45)***			(5.49)***
conxsic5			0.039			0.159
			(0.20)			(1.04)
conxsic6			0.207			0.070
			(6.36)***			(2.39)**
conxsic7			0.138			0.133
			(2.37)**			(1.68)*
conxsic8			0.213			0.045
			(7.30)***			(1.78)*
conxsic9			-0.036			-0.031
			(0.63)			(3.59)***
Controls:						
Workers' character.	yes	yes	yes	yes	yes	yes
Firms' character.	yes	yes	yes	no	no	no
Jobs' character.	yes	yes	yes	yes	yes	yes
Obs	3053	3053	3053	6994	6994	6994
Adjusted R-squared	0.49	0.50	0.51	0.85	0.85	0.86

Absolute value of t statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 5: OLS Regression - channel cost

	Main			Urgency		
	(1)	**(2)**	**(3)**	**(1')**	**(2')**	**(3')**
Contract	-0.132			0.017		
	(7.94)***			(0.55)		
conxsoc1		-0.093			-0.206	
		(1.78)*			(2.52)**	
conxsoc2		-0.182			-0.128	
		(7.46)***			(2.56)**	
conxsoc3		-0.070			0.404	
		(1.52)			(4.55)***	
conxsoc4		0.172			0.358	
		(2.81)***			(3.65)***	
conxsoc5		-0.941			-0.021	
		(12.47)***			(0.10)	
conxsoc6		-0.067			0.017	
		(1.98)**			(0.29)	
conxsoc7		-0.017			-0.049	
		(0.21)			(0.43)	
conxsoc8		0.110			0.028	
		(1.08)			(0.25)	
conxsoc9		-0.008			0.122	
		(0.04)			(0.19)	
conxsic1			0.040			0.182
			(0.42)			(0.94)
conxsic2			0.231			-0.042
			(3.73)***			(0.37)
conxsic3			-0.299			-0.151
			(9.24)***			(2.47)**
conxsic4			-0.256			-0.297
			(7.54)***			(4.73)***
conxsic5			-0.111			-0.378
			(0.51)			(0.81)
conxsic6			-0.245			0.001
			(6.70)***			(0.02)
conxsic7			0.007			0.082
			(0.11)			(0.76)
conxsic8			0.021			0.189
			(0.64)			(3.68)***
conxsic9			0.061			0.121
			(0.94)			(1.53)
Workers' character.:						
female	0.008	0.016	0.002	0.000	0.002	0.012
	(0.57)	(1.10)	(0.11)	(0.00)	(0.10)	(0.50)
Age:[1]						
19-24	0.035	0.036	0.026	0.140	0.130	0.137
	(1.35)	(1.44)	(1.01)	(3.48)***	(3.23)***	(3.45)***
25-34	0.136	0.145	0.140	0.249	0.233	0.239
	(5.11)***	(5.58)***	(5.36)***	(5.78)***	(5.44)***	(5.57)***
35-44	0.141	0.147	0.126	0.225	0.226	0.224
	(4.97)***	(5.29)***	(4.53)***	(4.84)***	(4.92)***	(4.84)***
45-54	0.023	0.093	0.035	0.300	0.264	0.296
	(0.65)	(2.63)***	(0.99)	(5.16)***	(4.54)***	(5.14)***
55 and over	0.155	0.181	0.203	0.235	0.288	0.319
	(2.15)**	(2.57)**	(2.85)***	(1.24)	(1.54)	(1.69)*
white	-0.063	-0.048	-0.055	0.079	0.069	0.067
	(2.72)***	(2.12)**	(2.44)**	(1.92)*	(1.68)*	(1.65)*
disability	0.117	0.109	0.114	0.300	0.302	0.213

	(1.97)**	(1.88)*	(1.96)**	(2.58)***	(2.62)***	(1.84)*
worker	0.065	0.054	0.058	0.008	0.021	-0.003
	(4.57)***	(3.90)***	(4.14)***	(0.33)	(0.84)	(0.13)
former employee	-0.090	-0.084	-0.093	-0.035	-0.051	-0.085
	(3.14)***	(3.00)***	(3.30)***	(0.80)	(1.17)	(1.93)*
Firms' character.:						
sic2	0.141	0.160	0.045	0.176	0.164	0.159
(metals/minerals)	(2.69)***	(3.11)***	(0.76)	(2.36)**	(2.22)**	(1.98)**
sic3	0.037	0.054	0.122	0.272	0.276	0.297
(metal goods/engineer.)	(0.81)	(1.19)	(2.40)**	(4.08)***	(4.20)***	(4.27)***
sic4	0.003	0.006	0.065	0.225	0.236	0.315
(other manufacturing)	(0.07)	(0.13)	(1.25)	(3.28)***	(3.48)***	(4.22)***
sic5	-0.017	-0.008	0.004	0.243	0.229	0.302
(construction)	(0.17)	(0.08)	(0.04)	(1.20)	(1.15)	(1.36)
sic6	-0.192	-0.168	-0.119	0.038	0.062	0.050
(distrib./catering)	(4.08)***	(3.63)***	(2.27)**	(0.55)	(0.92)	(0.69)
sic7	0.071	-0.004	0.013	0.200	0.191	0.124
(transport/commun.)	(1.30)	(0.07)	(0.19)	(2.39)**	(2.26)**	(1.13)
sic8	0.020	0.029	0.030	0.224	0.208	0.193
(banking/insurance)	(0.46)	(0.66)	(0.61)	(3.40)***	(3.20)***	(2.76)***
sic9	-0.035	-0.028	0.005	0.132	0.114	0.128
(other services)	(0.73)	(0.59)	(0.09)	(1.89)*	(1.65)*	(1.75)*
N° employees in UK:[2]						
100-200	-0.065	-0.087	-0.070	-0.093	-0.100	-0.111
	(1.27)	(1.75)*	(1.41)	(1.09)	(1.17)	(1.30)
200-500	-0.066	-0.085	-0.074	-0.081	-0.086	-0.082
	(1.52)	(2.01)**	(1.75)*	(1.16)	(1.25)	(1.19)
500-1000	-0.061	-0.065	-0.070	-0.071	-0.070	-0.068
	(1.45)	(1.56)	(1.67)*	(0.97)	(0.97)	(0.94)
1000-2000	-0.047	-0.048	-0.006	-0.128	-0.110	-0.078
	(1.07)	(1.12)	(0.15)	(1.75)*	(1.52)	(1.07)
2000-5000	-0.122	-0.129	-0.128	-0.060	-0.051	-0.037
	(2.86)***	(3.10)***	(3.05)***	(0.80)	(0.69)	(0.50)
5000-10000	-0.019	-0.016	-0.013	0.005	0.021	-0.010
	(0.44)	(0.37)	(0.32)	(0.07)	(0.29)	(0.14)
10000-50000	-0.064	-0.090	-0.071	-0.165	-0.165	-0.149
	(1.55)	(2.22)**	(1.73)*	(2.37)**	(2.40)**	(2.18)**
50000-100000	0.072	0.045	0.072	0.156	0.146	0.143
	(1.57)	(1.00)	(1.60)	(2.01)**	(1.90)*	(1.86)*
≥100000	0.055	0.040	0.012	-0.062	-0.209	-0.103
	(1.21)	(0.90)	(0.28)	(0.76)	(2.47)**	(1.28)
N° employees in the establishment	-0.000	-0.000	-0.000	0.000	0.000	0.000
	(1.57)	(1.98)**	(2.41)**	(2.26)**	(1.89)*	(1.70)*
(N° employees)^2	0.000	0.000	0.000	-0.000	-0.000	-0.000
	(0.37)	(1.16)	(1.72)*	(3.19)***	(2.76)***	(2.30)**
Production intensity:[3]						
at full capacity	-0.055	-0.058	-0.062	0.007	-0.019	0.000
	(1.05)	(1.13)	(1.21)	(0.11)	(0.29)	(0.00)
somewhat below f.c.	-0.088	-0.085	-0.084	0.022	0.004	0.030
	(1.63)	(1.60)	(1.58)	(0.31)	(0.06)	(0.42)
considerably below f.c.	0.058	0.062	0.026	0.231	0.204	0.210
	(0.84)	(0.93)	(0.38)	(2.08)**	(1.86)*	(1.90)*
Production trend:[4]						
expanding slowly	-0.019	-0.019	-0.016	-0.038	-0.042	-0.024
	(1.05)	(1.05)	(0.86)	(1.23)	(1.34)	(0.77)
stable	-0.135	-0.120	-0.112	-0.129	-0.111	-0.116
	(7.95)***	(7.22)***	(6.68)***	(4.40)***	(3.83)***	(3.96)***
contracting slowly	-0.082	-0.094	-0.061	-0.089	-0.075	-0.089

	(3.72)***	(4.30)***	(2.79)***	(2.21)**	(1.87)*	(2.25)**
contracting fast	-0.081	-0.075	-0.104	-0.286	-0.265	-0.263
	(1.80)*	(1.69)*	(2.33)**	(3.43)***	(3.20)***	(3.20)***
changeble	0.252	0.224	0.266	0.292	0.273	0.310
	(7.25)***	(6.36)***	(7.70)***	(5.09)***	(4.68)***	(5.45)***
workforce is:[5]						
1	0.000	0.000	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)	(.)	(.)
2	-0.036	-0.043	-0.125	-0.012	0.123	0.093
	(0.38)	(0.47)	(1.33)	(0.03)	(0.36)	(0.27)
3= satisfactory	-0.215	-0.226	-0.270	-0.084	0.004	-0.080
	(2.38)**	(2.55)**	(3.04)***	(0.25)	(0.01)	(0.24)
4	-0.056	-0.070	-0.137	-0.082	0.036	-0.091
	(0.63)	(0.80)	(1.56)	(0.24)	(0.11)	(0.27)
5	-0.084	-0.084	-0.132	-0.031	0.072	-0.023
	(0.97)	(0.99)	(1.55)	(0.09)	(0.22)	(0.07)
6	-0.115	-0.156	-0.165	-0.101	-0.015	-0.079
	(1.33)	(1.83)*	(1.93)*	(0.30)	(0.04)	(0.24)
7= major strenght	-0.088	-0.107	-0.140	-0.075	0.044	-0.057
	(1.01)	(1.27)	(1.65)	(0.22)	(0.13)	(0.17)
Region:[6]						
South West	-0.056	-0.014	-0.075	0.079	0.094	0.075
	(1.95)*	(0.50)	(2.66)***	(1.67)*	(2.01)**	(1.61)
West Mids	0.063	0.047	0.063	0.130	0.156	0.137
	(2.66)***	(2.00)**	(2.69)***	(3.05)***	(3.64)***	(3.21)***
E Mids/East	0.111	0.100	0.099	0.134	0.155	0.109
	(5.49)***	(4.94)***	(4.95)***	(3.73)***	(4.12)***	(3.02)***
York/Humber	0.126	0.124	0.121	0.116	0.153	0.136
	(4.43)***	(4.44)***	(4.32)***	(2.28)**	(3.01)***	(2.69)***
North West	0.020	0.013	0.025	0.054	0.086	0.056
	(0.79)	(0.51)	(1.03)	(1.41)	(2.22)**	(1.46)
North	0.163	0.127	0.171	0.089	0.126	0.108
	(5.70)***	(4.41)***	(6.07)***	(1.82)*	(2.59)***	(2.24)**
Wales	0.074	0.076	0.072	0.075	0.086	0.043
	(1.52)	(1.60)	(1.50)	(0.74)	(0.87)	(0.44)
Scotland	0.154	0.152	0.163	0.122	0.140	0.115
	(5.30)***	(5.30)***	(5.71)***	(2.58)***	(2.97)***	(2.45)**
Job characteristics:						
Standard recruitment procedures	0.004	0.004	0.009	0.068	0.070	0.061
	(0.16)	(0.17)	(0.34)	(1.65)*	(1.73)*	(1.49)
SOC:[7]						
soc2	-0.016	0.024	-0.002	-0.089	-0.082	-0.028
(operatives/assembly)	(0.58)	(0.71)	(0.07)	(1.80)*	(1.28)	(0.55)
soc3	0.289	0.295	0.267	0.266	0.151	0.230
(sales)	(9.22)***	(8.58)***	(8.57)***	(5.44)***	(2.67)***	(4.72)***
soc4	0.305	0.236	0.265	0.191	-0.054	0.154
(protect./personal service)	(8.62)***	(5.75)***	(7.50)***	(3.04)***	(0.68)	(2.42)**
soc5	0.155	0.269	0.124	0.209	0.128	0.169
(craft/skilled service)	(4.24)***	(6.73)***	(3.41)***	(3.54)***	(1.95)*	(2.83)***
soc6	0.361	0.352	0.338	0.310	0.242	0.278
(clerical/secretarial)	(12.40)***	(10.69)***	(11.57)***	(6.53)***	(4.27)***	(5.86)***
soc7	0.812	0.814	0.803	0.797	0.747	0.776
(assoc. profess./technical)	(23.33)***	(21.81)***	(23.36)***	(14.91)***	(12.30)***	(14.65)***
soc8	0.669	0.675	0.660	0.659	0.613	0.638
(professional)	(17.88)***	(17.11)***	(17.78)***	(11.15)***	(9.42)***	(10.88)***
soc9	0.749	0.751	0.734	0.724	0.680	0.710
(managers/admin.)	(16.62)***	(16.05)***	(16.51)***	(10.83)***	(9.41)***	(10.70)***
hourpay	0.015	0.016	0.017	0.020	0.021	0.023
	(5.31)***	(5.71)***	(6.16)***	(5.32)***	(5.73)***	(6.24)***

supervision task	0.123	0.126	0.118	0.092	0.084	0.081
	(5.37)***	(5.62)***	(5.27)***	(2.64)***	(2.43)**	(2.33)**
urgency				-0.130	-0.109	-0.116
				(5.94)***	(4.86)***	(5.32)***
Constant	-4.873	-4.891	-4.861	-5.426	-5.460	-5.429
	(39.22)***	(40.19)***	(39.15)***	(14.77)***	(15.05)***	(14.92)***
Observations	3053	3053	3053	1220	1220	1220
Adjusted R-squared	0.60	0.62	0.62	0.67	0.68	0.68

Absolute value of t statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

1: reference value "16-18"
2: reference value "<100"
3: reference value "Overloaded"
4: reference value "Expanding fast"
5: reference value "0= Major constraint on activities"
6: reference value "London/SE"
7: reference value "Routine/unskilled"

Table 6: FE Regression - channel cost

	Main			Urgency		
	(1)	**(2)**	**(3)**	**(1')**	**(2')**	**(3')**
Contract	-0.026			0.064		
	(2.52)**			(4.35)***		
conxsoc1		0.124			-0.090	
		(5.23)***			(1.99)**	
conxsoc2		-0.283			-0.091	
		(8.86)***			(1.44)	
conxsoc3		-0.241			0.021	
		(5.44)***			(0.26)	
conxsoc4		0.074			0.415	
		(2.72)***			(10.26)***	
conxsoc5		-0.299			-0.136	
		(5.45)***			(0.59)	
conxsoc6		-0.022			0.043	
		(1.15)			(1.36)	
conxsoc7		-0.025			0.097	
		(1.24)			(3.71)***	
conxsoc8		0.021			0.044	
		(1.15)			(1.89)*	
conxsoc9		-0.109			0.124	
		(1.96)**			(0.68)	
conxsic1			0.416			0.390
			(4.19)***			(3.07)***
conxsic2			0.086			-0.054
			(1.12)			(0.17)
conxsic3			-0.407			-0.201
			(11.83)***			(2.57)**
conxsic4			-0.285			-0.243
			(4.33)***			(1.08)
conxsic5			-0.007			-0.000
			(0.04)			(0.00)
conxsic6			-0.182			-0.063
			(4.57)***			(1.09)
conxsic7			-0.269			-0.787
			(2.50)**			(3.48)***
conxsic8			0.016			0.286
			(0.46)			(4.94)***
conxsic9			0.024			0.081
			(2.05)**			(5.07)***
Workers' character.:						
female	0.004	-0.001	0.007	-0.050	-0.082	-0.040
	(0.56)	(0.09)	(1.02)	(4.06)***	(6.58)***	(3.28)***
Age:[1]						
19-24	0.010	0.018	0.020	0.232	0.239	0.304
	(0.63)	(1.05)	(1.22)	(6.41)***	(6.63)***	(7.41)***
25-34	0.035	0.045	0.038	0.248	0.258	0.312
	(2.16)**	(2.68)***	(2.33)**	(6.54)***	(6.90)***	(7.27)***
35-44	0.013	0.017	0.016	0.211	0.180	0.271
	(0.78)	(0.98)	(0.92)	(5.53)***	(4.81)***	(6.32)***
45-54	0.028	0.034	0.028	0.152	0.152	0.216
	(1.45)	(1.69)*	(1.46)	(3.72)***	(3.69)***	(4.71)***
55 and over	0.020	0.046	0.031	0.078	0.099	0.132
	(0.65)	(1.50)	(1.01)	(0.91)	(1.17)	(1.49)
white	-0.090	-0.093	-0.084	-0.130	-0.181	-0.136
	(8.75)***	(8.71)***	(8.32)***	(8.69)***	(9.86)***	(9.16)***
disability	-0.001	-0.009	-0.010	-0.252	-0.386	-0.256

	(0.07)	(0.42)	(0.47)	(5.63)***	(8.02)***	(5.75)***
worker	0.028	0.019	0.019	-0.032	0.003	-0.040
	(3.57)***	(2.54)**	(2.43)**	(2.12)**	(0.20)	(2.63)***
former employee	-0.128	-0.124	-0.133	-0.210	-0.209	-0.198
	(10.02)***	(9.95)***	(10.66)***	(9.97)***	(10.18)***	(9.46)***
Job characteristics:						
Standard recruitment procedures	-0.027	-0.025	-0.016	-0.088	-0.104	-0.094
	(1.59)	(1.50)	(1.00)	(3.29)***	(3.95)***	(3.56)***
SOC:[2]						
soc2	-0.063	0.071	0.006	-0.072	-0.044	-0.043
(operatives/assembly)	(3.42)***	(3.32)***	(0.30)	(2.02)**	(0.86)	(1.11)
soc3	0.073	0.143	0.074	-0.185	-0.231	-0.207
(sales)	(3.51)***	(6.51)***	(3.62)***	(5.05)***	(5.96)***	(5.59)***
soc4	0.292	0.305	0.285	0.308	0.171	0.300
(protect./personal service)	(21.28)***	(19.82)***	(21.12)***	(13.21)***	(6.29)***	(12.99)***
soc5	0.166	0.218	0.115	0.472	0.341	0.294
(craft/skilled service)	(7.55)***	(9.09)***	(5.21)***	(10.17)***	(6.45)***	(4.38)***
soc6	0.317	0.357	0.304	0.291	0.284	0.268
(clerical/secretarial)	(26.88)***	(26.73)***	(26.19)***	(13.95)***	(11.84)***	(12.79)***
soc7	0.726	0.757	0.712	0.695	0.659	0.681
(assoc. profess./technical)	(56.81)***	(53.11)***	(56.48)***	(33.10)***	(27.47)***	(32.55)***
soc8	0.662	0.679	0.638	0.545	0.524	0.524
(professional)	(43.58)***	(39.13)***	(42.26)***	(22.76)***	(18.90)***	(21.74)***
soc9	0.715	0.743	0.688	0.575	0.603	0.563
(managers/admin.)	(33.90)***	(32.99)***	(32.84)***	(13.98)***	(13.93)***	(13.80)***
hourpay	0.006	0.006	0.007	0.026	0.026	0.027
	(4.00)***	(4.01)***	(4.53)***	(11.33)***	(11.02)***	(11.78)***
supervision task	0.046	0.053	0.057	0.044	0.019	0.050
	(4.71)***	(5.40)***	(5.84)***	(2.81)***	(1.22)	(3.19)***
urgency				0.040	0.045	0.029
				(2.90)***	(3.34)***	(2.10)**
Constant	-5.397	-5.454	-5.417	-5.335	-5.233	-5.382
	(133.91)***	(134.47)***	(136.93)***	(87.18)***	(81.62)***	(84.45)***
Observations	6994	6994	6994	3355	3355	3355
Adjusted R-squared	0.86	0.87	0.87	0.92	0.93	0.92

Absolute value of t statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

1: reference value "16-18"
2: reference value "Routine/unskilled"

Table 7: OLS Regression - channel speed

	Main			Urgency		
	(1)	(2)	(3)	(1')	(2')	(3')
Contract	0.163			0.217		
	(11.07)***			(8.97)***		
conxsoc1		0.254			0.377	
		(5.35)***			(5.58)***	
conxsoc2		0.137			0.265	
		(6.21)***			(6.41)***	
conxsoc3		0.206			0.266	
		(4.97)***			(3.63)***	
conxsoc4		-0.007			0.227	
		(0.12)			(2.81)***	
conxsoc5		0.314			0.097	
		(4.59)***			(0.55)	
conxsoc6		0.217			0.172	
		(7.10)***			(3.59)***	
conxsoc7		0.058			0.049	
		(0.76)			(0.52)	
conxsoc8		0.067			0.031	
		(0.72)			(0.33)	
conxsoc9		-0.459			0.021	
		(2.49)**			(0.04)	
conxsic1			0.282			0.216
			(3.30)***			(1.37)
conxsic2			-0.334			0.253
			(6.08)***			(2.73)***
conxsic3			0.127			0.148
			(4.41)***			(2.95)***
conxsic4			0.286			0.449
			(9.45)***			(8.75)***
conxsic5			0.039			0.247
			(0.20)			(0.65)
conxsic6			0.207			0.296
			(6.36)***			(4.95)***
conxsic7			0.138			0.202
			(2.37)**			(2.27)**
conxsic8			0.213			0.219
			(7.30)***			(5.22)***
conxsic9			-0.036			0.021
			(0.63)			(0.33)
Workers' character.:						
female	0.037	0.042	0.056	0.060	0.053	0.068
	(2.89)***	(3.30)***	(4.43)***	(3.01)***	(2.65)***	(3.42)***
Age:[1]						
19-24	0.085	0.083	0.091	0.285	0.289	0.292
	(3.72)***	(3.60)***	(4.03)***	(8.73)***	(8.72)***	(8.98)***
25-34	0.141	0.144	0.137	0.324	0.340	0.324
	(5.99)***	(6.09)***	(5.92)***	(9.25)***	(9.62)***	(9.24)***
35-44	0.129	0.128	0.128	0.340	0.346	0.328
	(5.11)***	(5.09)***	(5.15)***	(9.00)***	(9.14)***	(8.67)***
45-54	0.182	0.174	0.176	0.357	0.378	0.349
	(5.75)***	(5.42)***	(5.66)***	(7.54)***	(7.88)***	(7.42)***
55 and over	0.190	0.193	0.184	0.241	0.210	0.264
	(2.96)***	(3.01)***	(2.91)***	(1.57)	(1.37)	(1.72)*
white	0.033	0.030	0.024	0.044	0.031	0.044
	(1.62)	(1.46)	(1.18)	(1.32)	(0.91)	(1.31)
disability	0.070	0.068	0.059	-0.235	-0.217	-0.200

	(1.33)	(1.31)	(1.14)	(2.48)**	(2.28)**	(2.12)**
worker	0.005	0.007	0.008	0.071	0.073	0.082
	(0.44)	(0.57)	(0.64)	(3.40)***	(3.48)***	(3.97)***
former employee	0.014	0.017	0.028	0.017	0.037	0.041
	(0.54)	(0.65)	(1.11)	(0.48)	(1.01)	(1.14)
Firms' character.:						
sic2	-0.199	-0.196	-0.012	-0.154	-0.150	-0.145
(metals/minerals)	(4.28)***	(4.22)***	(0.22)	(2.54)**	(2.45)**	(2.21)**
sic3	0.119	0.125	0.139	0.010	0.002	0.035
(metal goods/engineer.)	(2.91)***	(3.05)***	(3.06)***	(0.19)	(0.03)	(0.61)
sic4	0.149	0.153	0.114	0.043	0.034	-0.046
(other manufacturing)	(3.63)***	(3.72)***	(2.47)**	(0.77)	(0.61)	(0.76)
sic5	0.077	0.087	0.136	0.127	0.163	0.132
(construction)	(0.86)	(0.98)	(1.36)	(0.77)	(0.99)	(0.72)
sic6	0.121	0.127	0.120	0.044	0.056	0.013
(distrib./catering)	(2.90)***	(3.04)***	(2.59)***	(0.79)	(1.00)	(0.22)
sic7	0.079	0.103	0.100	-0.019	-0.030	0.001
(transport/commun.)	(1.64)	(2.07)**	(1.65)*	(0.28)	(0.42)	(0.02)
sic8	0.023	0.021	0.030	-0.047	-0.041	-0.051
(banking/insurance)	(0.58)	(0.53)	(0.67)	(0.87)	(0.76)	(0.90)
sic9	0.138	0.154	0.163	-0.020	-0.006	-0.002
(other services)	(3.28)***	(3.66)***	(3.52)***	(0.35)	(0.11)	(0.03)
N° employees in UK:[2]						
100-200	-0.105	-0.107	-0.123	-0.251	-0.258	-0.250
	(2.31)**	(2.37)**	(2.76)***	(3.58)***	(3.66)***	(3.60)***
200-500	0.019	0.023	0.018	-0.109	-0.112	-0.090
	(0.49)	(0.60)	(0.46)	(1.93)*	(1.96)**	(1.59)
500-1000	-0.036	-0.038	-0.047	-0.079	-0.089	-0.068
	(0.95)	(1.02)	(1.25)	(1.33)	(1.49)	(1.16)
1000-2000	0.030	0.035	0.004	-0.028	-0.033	-0.047
	(0.78)	(0.92)	(0.09)	(0.46)	(0.54)	(0.79)
2000-5000	-0.057	-0.064	-0.054	-0.195	-0.195	-0.201
	(1.51)	(1.69)*	(1.45)	(3.20)***	(3.21)***	(3.31)***
5000-10000	-0.061	-0.068	-0.071	-0.132	-0.127	-0.128
	(1.62)	(1.81)*	(1.92)*	(2.30)**	(2.21)**	(2.25)**
10000-50000	-0.033	-0.025	-0.034	-0.127	-0.129	-0.134
	(0.89)	(0.68)	(0.93)	(2.24)**	(2.26)**	(2.38)**
50000-100000	-0.098	-0.092	-0.098	-0.201	-0.194	-0.201
	(2.42)**	(2.27)**	(2.44)**	(3.19)***	(3.07)***	(3.20)***
≥100000	-0.076	-0.080	-0.048	-0.056	-0.061	-0.063
	(1.89)*	(1.99)**	(1.21)	(0.85)	(0.87)	(0.95)
N° employees in the establishment	-0.000	-0.000	-0.000	0.000	0.000	0.000
	(1.64)	(0.90)	(1.90)*	(1.40)	(1.35)	(1.07)
(N° employees)^2	0.000	0.000	0.000	-0.000	-0.000	-0.000
	(2.31)**	(1.56)	(2.70)***	(1.24)	(1.32)	(0.89)
Production intensity:[3]						
at full capacity	0.063	0.073	0.071	0.057	0.063	0.070
	(1.35)	(1.56)	(1.54)	(1.02)	(1.13)	(1.25)
somewhat below f.c.	0.084	0.098	0.096	0.106	0.111	0.127
	(1.75)*	(2.05)**	(2.03)**	(1.83)*	(1.90)*	(2.17)**
considerably below f.c.	0.109	0.117	0.127	0.114	0.104	0.135
	(1.79)*	(1.92)*	(2.11)**	(1.26)	(1.14)	(1.50)
Production trend:[4]						
expanding slowly	0.110	0.105	0.084	0.054	0.039	0.040
	(6.88)***	(6.51)***	(5.17)***	(2.11)**	(1.50)	(1.56)
stable	0.124	0.118	0.100	0.076	0.071	0.068
	(8.24)***	(7.87)***	(6.69)***	(3.19)***	(2.95)***	(2.86)***
contracting slowly	0.032	0.032	0.005	-0.047	-0.048	-0.053

	(1.61)	(1.64)	(0.25)	(1.43)	(1.47)	(1.64)
contracting fast	0.055	0.052	0.060	-0.090	-0.091	-0.081
	(1.39)	(1.30)	(1.53)	(1.32)	(1.34)	(1.20)
changeble	0.179	0.208	0.180	0.122	0.121	0.113
	(5.82)***	(6.51)***	(5.86)***	(2.62)***	(2.52)**	(2.42)**
workforce is:[5]						
1	0.000	0.000	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)	(.)	(.)
2	-0.159	-0.171	-0.096	0.106	0.107	-0.062
	(1.89)*	(2.03)**	(1.15)	(0.38)	(0.38)	(0.22)
3= satisfactory	0.092	0.071	0.132	-0.190	-0.171	-0.273
	(1.15)	(0.89)	(1.67)*	(0.69)	(0.62)	(0.99)
4	-0.093	-0.118	-0.046	-0.355	-0.351	-0.447
	(1.17)	(1.49)	(0.59)	(1.29)	(1.27)	(1.62)
5	-0.089	-0.118	-0.057	-0.211	-0.203	-0.304
	(1.16)	(1.52)	(0.76)	(0.77)	(0.74)	(1.11)
6	-0.019	-0.035	-0.005	-0.195	-0.201	-0.312
	(0.24)	(0.46)	(0.07)	(0.71)	(0.73)	(1.14)
7= major strenght	-0.048	-0.072	-0.021	-0.201	-0.203	-0.297
	(0.63)	(0.94)	(0.28)	(0.74)	(0.74)	(1.09)
Region:[6]						
South West	0.127	0.120	0.140	-0.040	-0.036	-0.031
	(5.03)***	(4.66)***	(5.60)***	(1.03)	(0.95)	(0.81)
West Mids	0.058	0.065	0.056	-0.049	-0.032	-0.060
	(2.75)***	(3.04)***	(2.71)***	(1.41)	(0.89)	(1.72)*
E Mids/East	0.060	0.056	0.059	0.015	0.031	0.010
	(3.33)***	(3.07)***	(3.34)***	(0.52)	(0.99)	(0.32)
York/Humber	-0.093	-0.090	-0.072	0.027	0.038	0.009
	(3.69)***	(3.55)***	(2.90)***	(0.66)	(0.90)	(0.23)
North West	0.120	0.128	0.137	0.061	0.059	0.064
	(5.37)***	(5.65)***	(6.22)***	(1.93)*	(1.85)*	(2.03)**
North	0.037	0.052	0.023	-0.036	-0.031	-0.031
	(1.46)	(2.00)**	(0.91)	(0.90)	(0.77)	(0.79)
Wales	-0.054	-0.048	-0.021	-0.099	-0.072	-0.085
	(1.24)	(1.10)	(0.48)	(1.20)	(0.88)	(1.04)
Scotland	0.109	0.117	0.117	-0.007	0.013	0.013
	(4.24)***	(4.50)***	(4.59)***	(0.18)	(0.34)	(0.34)
Job characteristics:						
Standard recruitment procedures	-0.076	-0.072	-0.080	-0.095	-0.080	-0.081
	(3.25)***	(3.10)***	(3.49)***	(2.83)***	(2.38)**	(2.42)**
SOC:[7]						
soc2	0.003	0.039	0.033	-0.022	0.014	-0.036
(operatives/assembly)	(0.13)	(1.27)	(1.27)	(0.55)	(0.26)	(0.89)
soc3	-0.182	-0.165	-0.172	-0.263	-0.213	-0.243
(sales)	(6.56)***	(5.30)***	(6.21)***	(6.62)***	(4.55)***	(6.07)***
soc4	-0.253	-0.179	-0.223	-0.351	-0.295	-0.321
(protect./personal service)	(8.06)***	(4.80)***	(7.10)***	(6.88)***	(4.50)***	(6.17)***
soc5	-0.278	-0.275	-0.265	-0.359	-0.288	-0.363
(craft/skilled service)	(8.59)***	(7.59)***	(8.21)***	(7.48)***	(5.32)***	(7.45)***
soc6	-0.255	-0.238	-0.259	-0.358	-0.285	-0.359
(clerical/secretarial)	(9.86)***	(8.00)***	(9.98)***	(9.24)***	(6.09)***	(9.23)***
soc7	-0.484	-0.452	-0.479	-0.497	-0.421	-0.497
(assoc. profess./technical)	(15.67)***	(13.36)***	(15.70)***	(11.43)***	(8.40)***	(11.49)***
soc8	-0.626	-0.602	-0.631	-0.556	-0.485	-0.555
(professional)	(18.85)***	(16.85)***	(19.14)***	(11.56)***	(9.03)***	(11.59)***
soc9	-0.561	-0.518	-0.560	-0.588	-0.522	-0.592
(managers/admin.)	(14.01)***	(12.21)***	(14.16)***	(10.81)***	(8.74)***	(10.91)***
hourpay	0.000	0.001	0.003	-0.002	-0.001	-0.003
	(0.19)	(0.45)	(1.18)	(0.55)	(0.48)	(1.04)

supervision task	0.052	0.040	0.048	-0.016	-0.020	0.005
	(2.56)**	(1.98)**	(2.42)**	(0.57)	(0.69)	(0.18)
urgency				0.077	0.080	0.061
				(4.32)***	(4.30)***	(3.41)***
Constant	5.350	5.320	5.299	5.510	5.430	5.596
	(48.50)***	(48.25)***	(48.05)***	(18.43)***	(18.11)***	(18.81)***
Observations	3053	3053	3053	1220	1220	1220
Adjusted R-squared	0.49	0.50	0.51	0.57	0.57	0.58

Absolute value of t statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

1: reference value "16-18"
2: reference value "<100"
3: reference value "Overloaded"
4: reference value "Expanding fast"
5: reference value "0= Major constraint on activities"
6: reference value "London/SE"
7: reference value "Routine/unskilled"

Table 8: FE Regression - channel speed

	Main			Urgency		
	(1)	**(2)**	**(3)**	**(1')**	**(2')**	**(3')**
Contract	0.011			-0.026		
	(1.49)			(2.93)***		
conxsoc1		-0.003			0.072	
		(0.19)			(2.59)***	
conxsoc2		0.116			-0.062	
		(4.83)***			(1.59)	
conxsoc3		0.095			-0.009	
		(2.85)***			(0.17)	
conxsoc4		0.019			0.114	
		(0.91)			(4.60)***	
conxsoc5		0.139			-0.397	
		(3.37)***			(2.83)***	
conxsoc6		0.064			0.030	
		(4.52)***			(1.56)	
conxsoc7		-0.043			-0.027	
		(2.79)***			(1.68)*	
conxsoc8		-0.040			-0.100	
		(2.96)***			(6.99)***	
conxsoc9		-0.048			-0.055	
		(1.15)			(0.50)	
conxsic1			1.037			0.204
			(14.16)***			(2.66)***
conxsic2			0.137			0.162
			(2.42)**			(0.86)
conxsic3			0.082			-0.016
			(3.24)***			(0.33)
conxsic4			0.267			0.007
			(5.49)***			(0.05)
conxsic5			0.159			0.107
			(1.04)			(0.40)
conxsic6			0.070			0.060
			(2.39)**			(1.71)*
conxsic7			0.133			0.061
			(1.68)*			(0.45)
conxsic8			0.045			0.133
			(1.78)*			(3.81)***
conxsic9			-0.031			-0.043
			(3.59)***			(4.48)***
Workers' character.:						
female	0.025	0.027	0.021	0.029	0.023	0.032
	(4.57)***	(4.91)***	(4.02)***	(3.92)***	(2.95)***	(4.35)***
Age:[1]						
19-24	0.048	0.067	0.038	0.093	0.118	0.147
	(3.93)***	(5.32)***	(3.20)***	(4.26)***	(5.36)***	(5.93)***
25-34	0.063	0.084	0.050	0.095	0.121	0.151
	(5.13)***	(6.54)***	(4.16)***	(4.18)***	(5.33)***	(5.82)***
35-44	0.065	0.088	0.054	0.090	0.106	0.145
	(5.11)***	(6.62)***	(4.35)***	(3.95)***	(4.62)***	(5.60)***
45-54	0.034	0.060	0.024	0.011	0.052	0.069
	(2.36)**	(3.94)***	(1.72)*	(0.44)	(2.06)**	(2.50)**
55 and over	0.107	0.125	0.080	0.136	0.184	0.194
	(4.67)***	(5.40)***	(3.60)***	(2.62)***	(3.54)***	(3.63)***
white	-0.003	0.004	0.000	0.010	-0.016	0.009
	(0.40)	(0.48)	(0.02)	(1.10)	(1.44)	(1.05)
disability	0.011	0.018	0.020	0.146	0.159	0.163

	(0.68)	(1.12)	(1.25)	(5.41)***	(5.43)***	(6.07)***
worker	-0.002	0.001	0.003	0.060	0.066	0.061
	(0.35)	(0.23)	(0.45)	(6.64)***	(7.16)***	(6.69)***
former employee	0.040	0.037	0.039	0.068	0.060	0.065
	(4.22)***	(3.93)***	(4.27)***	(5.33)***	(4.80)***	(5.15)***
Job characteristics:						
Standard recruitment procedures	-0.038	-0.039	-0.044	-0.016	-0.007	-0.016
	(3.09)***	(3.13)***	(3.65)***	(1.00)	(0.42)	(0.97)
SOC:[2]						
soc2	0.040	-0.000	0.019	0.022	0.091	0.021
(operatives/assembly)	(2.91)***	(0.02)	(1.39)	(1.02)	(2.92)***	(0.91)
soc3	-0.079	-0.091	-0.071	0.030	0.063	0.044
(sales)	(5.05)***	(5.47)***	(4.68)***	(1.38)	(2.66)***	(1.97)**
soc4	-0.190	-0.191	-0.187	-0.287	-0.305	-0.284
(protect./personal service)	(18.60)***	(16.44)***	(18.81)***	(20.47)***	(18.41)***	(20.34)***
soc5	-0.227	-0.232	-0.214	-0.232	-0.200	-0.225
(craft/skilled service)	(13.87)***	(12.84)***	(13.16)***	(8.32)***	(6.20)***	(5.54)***
soc6	-0.172	-0.183	-0.171	-0.233	-0.208	-0.231
(clerical/secretarial)	(19.58)***	(18.13)***	(19.87)***	(18.62)***	(14.21)***	(18.24)***
soc7	-0.392	-0.380	-0.386	-0.440	-0.422	-0.437
(assoc. profess./technical)	(41.19)***	(35.32)***	(41.40)***	(34.85)***	(28.82)***	(34.54)***
soc8	-0.399	-0.376	-0.385	-0.407	-0.349	-0.398
(professional)	(35.24)***	(28.72)***	(34.52)***	(28.31)***	(20.64)***	(27.29)***
soc9	-0.394	-0.375	-0.385	-0.403	-0.345	-0.399
(managers/admin.)	(25.07)***	(22.05)***	(24.87)***	(16.31)***	(13.06)***	(16.17)***
hourpay	-0.001	-0.002	-0.001	-0.005	-0.007	-0.005
	(0.73)	(1.33)	(0.67)	(3.48)***	(4.76)***	(3.37)***
supervision task	-0.014	-0.025	-0.021	-0.018	-0.032	-0.026
	(1.85)*	(3.36)***	(2.91)***	(1.92)*	(3.29)***	(2.73)***
urgency				0.029	0.021	0.024
				(3.59)***	(2.62)***	(2.84)***
Constant	5.642	5.629	5.649	5.452	5.438	5.389
	(187.92)***	(184.04)***	(193.21)***	(148.19)***	(138.97)***	(139.92)***
Observations	6994	6994	6994	3355	3355	3355
Adjusted R-squared	0.85	0.85	0.86	0.93	0.93	0.93

Absolute value of t statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

1: reference value "16-18"
2: reference value "Routine/unskilled"