Company Start-Up Costs and Employment*

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Abstract

I study the role of company start-up costs for employment performance. The model is search equilibrium with a new concept for firms. Agents have an innate managerial ability and make a career choice to become either managers or workers. Managers set up firms, post jobs and match with workers. There is a unique equilibrium career choice, which is also optimal if the wage rule internalizes the search externalities. I show that higher start-up costs reduce overall employment but increase the size of incumbent firms. I discuss some cross-country OECD evidence which supports the model's main proposition.

Keywords. Start-up costs, regulation, employment, OECD unemployment, search and matching.

This paper is a contribution to the literature that explains cross-country differences in employment or unemployment rates in terms of structural models of the economy. Edmund Phelps contributed to this literature with his important book *Structural Slumps*.[1] My focus in this paper is on a factor that has been neglected in previous studies, the regulation of new company start-ups.

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[1] Earlier seminal contributions include Bruno and Sachs' (1985) *Economics of World-wide Stagflation* and Layard, Nickell and Jackman's (1991) *Unemployment: Macroeconomic Performance of the Labour Market.* For a more recent contribution see Blanchard (1999) and Blanchard and Wolfers (2000).

With the increasing inter-dependence of the world's industrial economies, the differences in the performance of labor markets are more likely the outcome of different institutional structures than of different experiences with macroeconomic or policy shocks. Recent evidence has revealed large differences in the regulatory environment for company start-ups across countries, even within the OECD.[2] The important quantifiable variables in this framework are currently policy related: the legal rules and regulations that a new entrepreneur has to comply with before starting his or her new company. But other factors, for example those related to the availability of finance and the stigma attached to bankruptcy, are also important ingredients of this institutional structure.

My primary objective in this paper is to discuss the theory underlying the connection between start-up costs and employment performance. I will strip the model of many important elements that careful empirical study has to take into account, in order to focus on the key links between start-up costs and employment. The model that I use builds on another seminal contribution of Phelps's, search equilibrium, but uses the more recent framework developed in my book (Pissarides, 2000) and the ideas about entrepreneurship used by Lucas (1978) in his "span-of-control" model. I also discuss some preliminary empirical work with OECD data, which gives encouraging results about the model's main predictions.

In order to find a role for start-up costs in the determination of employment I need a precise definition of the firm and the incentives that entrepreneurs have for creating firms. I define a firm as a collection of jobs, each one occupied by a worker or vacant, and managed by an entrepreneur. The entrepreneur is both the owner and the manager of the firm. The overall cost of managing a firm depends on the number of jobs managed and on a parameter which is specific to the manager, and which summarizes the agent's "managerial skill" or "entrepreneurship". Agents choose whether to become entrepreneurs or workers by maximizing expected lifetime income. I show that the choice of career is determined by a cut-off managerial ability, with more able managers choosing to set up their own firms and create jobs. Employment is determined by an aggregate matching function which matches the posted jobs with the agents who choose to become workers.

In contrast to Lucas's (1978) model, managerial skill in my model does

[2] For preliminary results with OECD data see Fonseca et al. (2001). For a different and more comprehensive set of data, covering 75 countries, see Djankov et al. (2000).

not influence the firm's total factor productivity. More able managers in my model spend fewer resources on managing their firm but produce the same output for each job that they own as less able managers. This property enables the derivation of a conventional search and matching equilibrium conditional on the numbers of managers and workers. I do not consider the role of capital and savings, although their introduction should not be difficult, given existing results in search theory.

Section 1 describes the theoretical framework and the key assumption about managers and workers. Section 2 derives the equilibrium as a solution to a social planning problem, and section 3 derives the decentralized search equilibrium. I show that the two coincide when the search externalities are internalized. Section 4 derives the properties of the employment and wage distributions across firms and studies the role of start-up costs in the determination of these distributions. Section 5 presents some preliminary evidence from 17 OECD countries supporting the link between start-up costs and employment.

1 The economy

The economy consists of a continuum of infinitely-lived individuals in the unit interval. Each individual can be either a worker or a manager. Managers establish a firm that they own, create jobs and recruit workers. A manager can manage many jobs at the same time but a worker can only occupy one job at a time. A firm is a collection of jobs headed by a single manager.[3]

All agents have linear utility functions and capital markets are perfect and characterized by a safe interest rate r. Agents decide to become workers or managers by maximizing utility under rational expectations over their horizon. They are identical in all respects except for their managerial ability, or "entrepreneurship." Managerial ability is summarized in a function that gives the cost of managing jobs. The cost of managing α jobs is given by $xg(\alpha)$, with $x \in [x_0, \infty)$ and $g(\alpha)$ increasing and convex. The parameter x is specific to each individual and has known distribution $F(x)$ over the popula-

[3] Although I do not refer explicitly to self employment, the model can easily be extended to deal with it. For example, a self employed individual can be interpreted as a firm that yields some output with no workers besides the manager. I simplify the exposition by assuming that although managers are never unemployed, the firm cannot yield output without workers.

tion. Good managers have low x, poor managers have a high x. Managerial ability influences only the cost of management. It does not influence the productivity of the worker or manager.

When a firm is first created, the manager posts α job vacancies and workers arrive according to the parameters of a matching technology. The number α is chosen optimally to maximize profit, so in general it will depend on x. Because a firm is owned and headed by a single manager, we can identify firms with managers and with the parameter x. We can therefore refer to firm x or manager x.When the firm is mature some of its $\alpha(x)$ jobs will be occupied and some vacant. We refer to the occupied jobs as employment in firm x, and denote it by $n(x)$. Posted vacancies in firm x are then given by $\alpha(x) - n(x) \geq 0$. The cost of managing a job is the same irrespective of whether it is vacant or filled, an assumption that can easily be relaxed.

Each occupied job produces a constant flow of output y and continues producing this output until the worker leaves. In the simple version of the model in this paper I assume that there are no productivity shocks and the only reason for the interruption of production is an exogenous process that separates workers from jobs. The separation process could be interpreted as exogenous death and replacement of the worker or manager, with only trivial modifications to the argument. I simplify the exposition by assuming that there is no death and replacement, all agents have infinite horizons but they are separated at constant Poisson rate λ. After separation the job is re-advertised as a vacancy and the worker becomes unemployed to search for another job. Unemployed workers enjoy income flow b but job vacancies produce and cost nothing (with the exception of their management cost).

The allocation of jobs to workers is modelled as in the simplest case analyzed in Pissarides (2000, chapter 1), with an important modification necessitated by the introduction of managers. Suppose at some time t entrepreneurs have created and are managing a total of $n + v$ jobs, with n of them occupied by workers and v of them vacant. There are $n + u$ workers in this market, one in each occupied job and u unemployed. The v vacant jobs and u unemployed workers engage in a process of search and matching governed by an aggregate matching function with constant returns to scale. It is shown in Pissarides (2000, chapter 1) that under these assumptions the arrival process can be summarized by a single parameter, the tightness of the market $\theta \equiv v/u$, such that: workers arrive to jobs according to a Poisson rate $q(\theta)$, which has elasticity in the interval $(-1, 0)$, and jobs arrive to unemployed workers according to a related Poisson rate $\theta q(\theta)$, with elasticity in the interval $(0,1)$ and with

$$\lim_{\theta\to\infty} q(\theta) = \lim_{\theta\to 0} \theta q(\theta) = 0 \tag{1}$$

$$\lim_{\theta\to 0} q(\theta) = \lim_{\theta\to\infty} \theta q(\theta) = \infty \tag{2}$$

2 The social planning problem

The social planner chooses which workers to make managers and how many jobs to create for each. She is constrained by the evolution of aggregate employment implied by the matching and job-separation processes and by the fact that matching is pairwise.

Let $\alpha(x)$ be the number of jobs allocated to each manager x. Given the structure of the model, in particular the assumption that entrepreneurship influences management costs proportionally but does not influence productivity, the division of agents between managers and workers is described by a single cutoff point R, such that agents with $x \leq R$ become managers and agents with $x > R$ become workers. I will adopt this restriction in the social planning problem and show later that it is optimal.

Managers are always employed and spend $xg(\alpha(x))$, for given ability x, on managing their jobs. Workers can be either employed and producing y or unemployed and enjoying utility flow b. Social output is given by

$$Y = \int_0^\infty e^{-rt} \left(n(y-b) - \int_{x_0}^R (xg(\alpha(x)) + b)\, dF(x) \right) dt, \tag{3}$$

where n, a function of time, is aggregate employment. The first term in the brackets shows the social gain from employment, with n workers giving up income flow b for output y. The terms in the second integral show the manager's costs and the integral sums them over all the individuals who become managers, those with managerial ability from x_0 to the reservation R. The first term shows the cost of managing the $\alpha(x)$ jobs that the social planner allocates to manager x and the second term shows the opportunity cost of employment of each manager.

The social planner's constraints are first, the evolution of aggregate employment, and second the fact that the flow of workers into employment must be equal to the flow of jobs. I write the evolution of employment in terms of worker transitions. With the total labor force having measure 1, the measure of managers in this economy is given by $F(R)$ and the measure of workers by $1 - F(R)$. For any arbitrary employment level n, there are $1 - F(R) - n$ unemployed workers who transit to employment at rate $\theta q(\theta)$. Employed workers transit to unemployment at constant rate λ, yielding the differential equation that gives the evolution of employment,

$$\dot{n} = (1 - F(R) - n)\theta q(\theta) - \lambda n. \tag{4}$$

The measure of jobs that transits from vacant state to employment is given by the product of the measure of vacancies and the transition rate for vacant jobs. The former is $\int_{x_0}^{\infty} \alpha(x)dF(x) - n$, the difference between the total number of jobs allocated by the planner to the agents who become managers and employment, and the transition rate for vacant jobs is $q(\theta)$. Therefore, the planner's second constraint is,

$$\int_{x_0}^{R} \alpha(x)dF(x) - n - \theta\left(1 - F(R) - n\right) \geq 0. \tag{5}$$

The Euler conditions for the maximization of (3) subject to (4) and (5) are given in the Appendix. It is shown that in the social planning equilibrium the marginal cost of managing one more job is equalized across managers; i.e. $xg'(\alpha(x))$ is independent of x. This is a consequence of the fact that the productivity of a job is independent of the manager's ability and the marginal management cost is equated to the marginal revenue from one more job across all firms. Let the marginal management cost be denoted by ϕ.

I focus on steady states. The Appendix shows that labor market tightness and the managerial cutoff respectively satisfy

$$(1 - \eta)(y - b - \phi) - \eta\theta\phi - \frac{r + \lambda}{q(\theta)}\phi = 0 \tag{6}$$

$$Rg(\alpha(R)) + b - \left(\alpha(R) - \frac{\eta}{1 - \eta}\theta\right)\phi = 0 \tag{7}$$

where η is the absolute value of the elasticity of $q(\theta)$. This elasticity is a number between 0 and 1 by the properties of the matching technology but may be either a constant or a function of θ.[4] Note that ϕ here depends on the equilibrium outcome (although not on any realization of x), so (6)

[4] It is constant if the matching function is Cobb-Douglas, an assumption that has proved popular in the empirical literature but not in theoretical derivations of the matching function. See Petrongolo and Pissarides (2001).

and (7) cannot yet be solved for the pair (R, θ). This is in contrast to the conventional model of search equilibrium which makes use of a zero-profit condition for vacancy entry to derive two equations in the two unknowns R and θ.

To solve for the unknowns we make use of the two constraints, (4) and (5). Aggregate employment in the steady state satisfies

$$n = \frac{\theta q(\theta)}{\theta q(\theta) + \lambda}(1 - F(R)) \tag{8}$$

$$= \frac{q(\theta)}{q(\theta) + \lambda} \int_{x_0}^{R} \alpha(x) dF(x). \tag{9}$$

But aggregate employment is also the sum of employment in each firm

$$n = \int_{x_0}^{R} n(x) dF(x), \tag{10}$$

suggesting the following distribution of employment across firms:

$$n(x) = \frac{q(\theta)}{q(\theta) + \lambda}\alpha(x). \tag{11}$$

The social planning equilibrium is obtained as follows. (6) and (7) are solved for θ and R in terms of $\alpha(R)$, given that $\phi = Rg'(\alpha(R))$. Equilibrium condition (8) can then be used to obtain n, also in terms of $\alpha(R)$. Writing next $xg'(\alpha(x)) = Rg'(\alpha(R)) \; \forall x$, we obtain $\alpha(x)$ for all active managers in terms of $\alpha(R)$.[5] $\alpha(R)$ is then obtained from (5), by substituting into it the solutions for $\alpha(x), n, \theta$ and R.

3 Decentralized search equilibrium

There are several ways in which a decentralized search equilibrium can be specified and solved. The key properties of a search equilibrium, which were noted by Phelps in his two seminal contributions in search theory (Phelps et al., 1970, Phelps 1972), are first, that search frictions introduce monopoly rents, and second, in the decentralized solution the dependence of the aggregate arrival rates on individual actions are ignored. The first implies that we

[5] For example, if $g(\alpha) = \gamma\alpha^2/2$, $\alpha(x) = \alpha(R)R/x$.

need a monopoly solution to wage determination and the second that there are congestion externalities that are likely to be ignored in the individual optimization problems. In this paper I will study the decentralized equilibrium when wages split the monopoly rents from each job between the worker and the manager according to the arbitrary constant $\beta \in (0, 1)$, with β denoting the share of the worker in each job. This solution to wage determination is different from the "wage posting" solution adopted by Phelps in his seminal contributions (and more recently by Burdett and Mortensen (1998), among others). It can be derived from the solution to the static Nash bargain, when the bargain takes place between isolated pairs of managers and workers, but I will not explore its foundations here and treat β as arbitrary.

3.1 Managers and workers

If an individual decides to become a worker, she can search for a job offered by a manager. If she becomes an entrepreneur, she can create α jobs and post vacancies waiting for workers to arrive. Individuals decide whether to become managers or workers by maximizing income over an infinite horizon, with constant discount rate r.

Let U be the present discounted value of income of the searching worker and V the expected PDV of profit income from a vacant job. Both U and V are independent of the individual's managerial ability x. The cost of managing α jobs is $xg(\alpha)$, irrespective of whether they are occupied or vacant. Therefore, with infinite horizon, in the steady state the total management cost paid by an x individual who creates α jobs is $xg(\alpha)/r$. By creating one more job a manager can enjoy additional income over the infinite horizon of V, for an additional lifetime management cost of $xg'(\alpha)/r$. Therefore, the optimal α satisfies

$$xg'(\alpha(x)) = rV. \tag{12}$$

As in the social planning solution, the marginal cost of managing a job is constant across firms. In the decentralized equilibrium it is equal to the "permanent income" generated by a new job vacancy, the marginal revenue from the posting of one more job vacancy.

If an x individual becomes an entrepreneur and creates $\alpha(x)$ jobs, her initial net expected payoff is $\alpha(x)V - xg(\alpha(x))/r$. If she becomes a worker, her initial payoff is U. Therefore, individuals whose x satisfies the following inequality become entrepreneurs:

$$\max_{\alpha}\{\alpha V - xg(\alpha)/r\} \geq U. \tag{13}$$

As expected, the maximization condition is (12). Agents who become entrepreneurs will post the maximum number of jobs immediately.

Individuals who have been entrepreneurs for a while will have some jobs filled and some vacant. Because of the obvious property that filled jobs do not have lower expected payoffs than vacant jobs, no agent who satisfies inequality (13) will drop out of entrepreneurship and become a worker after some jobs are filled. Similarly, individuals who do not satisfy (13), and are therefore workers, will eventually find a job. Because the expected returns from employment are at least as high as the expected returns from unemployment, if (13) is not satisfied for an unemployed worker it will not be satisfied for an employed worker. Therefore, (13) is a general condition for the allocation of agents between entrepreneurship and worker status.

V and U are both independent of x by assumption, so (13) satisfies the reservation property: there is a reservation managerial ability R, such that an x individual becomes an entrepreneur if $x \leq R$, otherwise she becomes a worker. The reservation ability satisfies

$$R = \frac{\alpha(R)rV - rU}{g(\alpha(R))} \tag{14}$$

with $Rg'(\alpha(R)) = rV$. Conditions (13) and (14) state the obvious property that the income flow from the α jobs, $\alpha(x)rV$, has to cover their management cost and the loss of the expected returns from search of all workers who become managers.

3.2 Expected payoffs

The expected payoffs to workers and job owners are derived as in conventional search models. The PDV of income of a posted vacancy, V, satisfies

$$rV = q(\theta)(J - V), \tag{15}$$

where J are the expected returns from an occupied job, which satisfy

$$rJ = y - w - \lambda(J - V). \tag{16}$$

The job switches between employment and vacancy according to the transition rates $q(\theta)$ and λ. When it is vacant it produces and costs nothing but when it is filled it produces y, yielding net income $y - w$ to the manager, with w going to the worker. Management costs can be ignored in these calculations because they are the same for both vacancies and filled jobs.

The unemployed worker's PDV of income, U, satisfies

$$rU = b + \theta q(\theta)(W - U), \tag{17}$$

where W are the expected returns from holding a job, and satisfy

$$rW = w - \lambda(W - U). \tag{18}$$

The worker moves from unemployment to employment and back at rates $\theta q(\theta)$ and λ respectively, with income in unemployment given by b and in employment by w.

Wages share the surplus from the job match according to the fixed parameter $\beta \in (0, 1)$. Total surplus is given by $J - V + W - U$, with $J - V$ going to the owner of the job and $W - U$ going to the worker. Therefore wages solve

$$(1 - \beta)(W - U) = \beta(J - V). \tag{19}$$

From (17), (19) and (15), we obtain

$$rU = b + \frac{\beta\theta}{1 - \beta} rV. \tag{20}$$

Next, adding up the value equations (15)-(18) and making use of the sharing rule (19) to substitute out $W - U$ and $J - V$ in terms of the surplus from the job, we obtain the following expression for the surplus:

$$J - V + W - U = \frac{y - b}{(1 - \beta)q(\theta) + r + \lambda + \beta\theta q(\theta)}. \tag{21}$$

Finally, (15) yields

$$rV = \frac{(1 - \beta)q(\theta)(y - b)}{(1 - \beta)q(\theta) + r + \lambda + \beta\theta q(\theta)}. \tag{22}$$

We can therefore write $V = V(\theta)$, with $V'(\theta) < 0$. This is an important property: intuitively, the larger the number of jobs posted by all firms for each unemployed worker, the less the expected profit of each firm from posting one more vacancy. The reason for this result is the congestion externality caused by the posting of vacancies, because production is not characterized by diminishing returns to the number of jobs. The implications for equilibrium, however, are similar. At the aggregate level, the marginal profit from one more job falls as the number of jobs increases.

Given now (22), (20) implies that $U = U(\theta)$ with $U'(\theta) > 0$. Workers are made better off when more jobs are posted for each unemployed worker. Once again, the reason for this result is the search externality associated with these models.

Note finally that although we cannot say in general whether the PDV of income is higher or lower for a worker or her manager, it follows immediately from the value equations that for as long as $y > b$, a necessary condition for a nontrivial equilibrium, $J \geq V$ and $W \geq U$; i.e. both managers and workers are better off when they are producing than when they are searching. These inequalities confirm that if the career choice condition (13) is satisfied for unemployed agents then it is certainly satisfied for employed ones.

3.3 Equilibrium

An equilibrium is defined as a reservation managerial ability R, a market tightness θ, and distributions of jobs, employment and wages $(\alpha(x), n(x), w(x))$ across managers, given the distribution of abilities $F(x)$. The equilibrium satisfies the value equations (15)-(18), the wage sharing rule, (19), the career choice rule (13), the marginal job entry rule, (12) and the equation for the evolution of employment in each firm,

$$\dot{n}(x) = (\alpha(x) - n(x))\theta q(\theta) - \lambda n(x). \tag{23}$$

I illustrate the solution with the help of a diagram.

The results in (20) and (22) imply that the equilibrium R, which satisfies (14), is a monotonically decreasing function of aggregate tightness, θ. When tightness is higher, managers find it more difficult to recruit workers, so fewer individuals decide to start their own companies and more become workers. This relationship is shown in (R, θ) space as a downward-sloping curve labeled "entrepreneurship" (see figure 1). The limits to this curve are derived as follows.

If $\theta = 0$, (22) and (1), (2) imply $rV = y - b$ and (20) implies $rU = b$. Therefore, from (14) we derive $Rg(\alpha(R) = \alpha(R)(y-b)-b$, where $Rg'(\alpha(R)) =$

$y-b$. This gives the maximum feasible value of R. It also follows from (13) that for any choice of $\alpha(x)$, in a feasible equilibrium $\alpha(x)V(\theta) \geq U(\theta) + xg(\alpha(x)) > 0$. Define therefore $\bar{\theta}$ by $V(\bar{\theta}) = 0$ and θ_0 by $\alpha(x_0)V(\theta_0) = U(\theta_0) + x_0 g(\alpha(x_0))$. Equilibrium is non-trivial only for values of θ that satisfy $\theta \leq \theta_0 < \bar{\theta}$. $\bar{\theta}$ is the equilibrium value of tightness in models that derive the demand for labor from a zero-profit condition on the value of a new vacancy (as in Pissarides, 2000; of course, if there are management costs in these models, the zero-profit condition would have to take them into account). θ_0 is the tightness level at which finding a new worker is so difficult, that only the most able manager in the market will choose to become an employer. See figure 1.

In order to derive a second equilibrium relationship between θ and R, consider the definition of θ as the ratio of aggregate vacancies to unemployment. With each firm owner creating $\alpha(x)$ jobs, aggregate vacancies for any aggregate employment level n measure $\int_{x_0}^{R} \alpha(x)dF(x) - n$, and with all agents with managerial ability at least as good as R becoming managers, unemployment is $1 - F(R) - n$, yielding

$$\theta = \frac{\int_{x_0}^{R} \alpha(x)dF(x) - n}{1 - F(R) - n}. \tag{24}$$

The evolution of aggregate employment is given by aggregating over x in (23), which gives the same expression as in the planning equilibrium, since the social planner is constrained by the same matching frictions as individual agents. Therefore, in the decentralized steady state employment satisfies two expressions similar to (8) and (9), with θ, R and $\alpha(x)$ satisfying the decentralized equilibrium. Substitution from (8) and (9) into (24) yields

$$\frac{\theta q(\theta) + \theta\lambda}{\theta q(\theta) + \lambda} = \frac{\int_{x_0}^{R} \alpha(x)dF(x)}{1 - F(R)}. \tag{25}$$

Now, from (12) and (22) each $\alpha(x)$ is a function of x and $V(\theta)$, with

$$\frac{\partial\alpha(x)}{\partial\theta} = \frac{\partial\alpha(x)}{\partial V}\frac{\partial V}{\partial\theta} < 0 \qquad \forall x. \tag{26}$$

Total differentiation of (25) therefore gives $d\theta/dR > 0$: at higher R there are more managers and fewer workers, so more jobs are created and posted for each job seeker. We refer to this curve in (R, θ) space as job creation. As $R \to x_0$, $\theta \to 0$, giving the shape of the curve shown in figure 1.

Equilibrium is now straightforward to obtain. The equilibrium R and θ are unique and shown by the intersection of the two curves in figure 1. With knowledge of R and θ, V and U can be obtained from (20) and (22), and (12) then gives $\alpha(x)$ for each firm x. With knowledge of $\alpha(x)$, employment in each firm is obtained from (23). To obtain wages, note that the value equation (16) can be rearranged to yield

$$J - V = \frac{y - w - rV}{r + \lambda} \tag{27}$$

and the one for W, (18), yields

$$W - U = \frac{w - rU}{r + \lambda}. \tag{28}$$

Substitution into the sharing rule (19) gives

$$w = (1 - \beta)rU + \beta(y - rV), \tag{29}$$

which can be solved for wages. It is noteworthy that wages are common across all jobs and managers: better managers do not pay more, despite the decentralized sharing rule and the frictions that do not eliminate monopoly rents.

3.4 Efficient search equilibrium

We define efficient search equilibrium as the decentralized equilibrium that satisfies the social planning solution. In general, the sharing solution that I have used to derive wages does not give the efficient solution, because the individuals setting wages ignore the effects of their choices on the transition rates of unmatched individuals.

It is clear from inspection of the conditions that characterize the planning equilibrium and the decentralized equilibrium, that the two coincide if the decentralized solution can be shown to yield (6) and (7). The other two equations that give the planning solution, the constraints, are common to the decentralized solution. Straightforward manipulation of (6) gives

$$\phi \equiv xg'(\alpha(x)) = \frac{(1 - \eta)q(\theta)(y - b)}{(1 - \eta)q(\theta) + r + \lambda + \eta\theta q(\theta)}. \tag{30}$$

But because of (12) and (22) , the decentralized equilibrium can also give this condition if $\eta = \beta$; i.e., the familiar condition for the internalizing of the search externalities in the decentralized search equilibrium without managers also internalizes the search externalities in the managers' job creation decisions (Hosios 1990, Pissarides 2000). To check whether the allocation of agents between managers and workers is also efficient, note that (7) implies

$$Rg(\alpha(R)) = \alpha(R)\phi - (b + \frac{\eta}{1-\eta}\theta\phi), \tag{31}$$

which, given that in the decentralized equilibrium $\phi = rV$, is precisely (14) when $\beta = \eta$ (given the property in (20)). Therefore, the condition for the efficiency of the decentralized search equilibrium also implies an efficient allocation of agents between entrepreneurs and workers.

4 The role of start-up costs

In the equilibrium derived in the preceding section agents could become managers and set up a firm without any fixed costs or waiting time. Evidence, however, points to large start-up costs, in the form of legal procedures that have to be satisfied before a business firm can open its doors, waiting time for the permit to arrive and a fee that has to be paid to the authorities. Our framework is ideally suited to the introduction of costs of this kind. Although in the simple version of the model that I described here all costs have similar impact on the equilibrium allocation of agents and job creation, I will consider the role of three distinct costs.

First, an agent who decides to become entrepreneur has to start legal procedures for the creation of her company. Next, a permit giving the licence to start operating comes with some randomness. And finally, when the permit arrives, the entrepreneur has to pay a fee to the authorities to receive the registration documents. I assume that permits arrive stochastically, at rate $a > 0$. The expected waiting time for a new company is $1/a$. This rate is influenced mainly by policy, although in many countries it is possible to speed up the procedure by paying "bribes" (see Djankov et al., 2000). During the waiting time, the entrepreneur has to give up her worker status and pay some out-of-pocket costs to go through the necessary procedures. I represent these costs as a flow $c \geq 0$, paid until the permit arrives. When the permit arrives, a fee $s \geq 0$ is paid and the company starts operation.

A new company headed by an individual of ability x starts operations with $\alpha(x)$ posted vacancies, which satisfy the marginal condition (12). The value of the firm at start-up is $\alpha(x)V(\theta) - xg(\alpha(x))$, which I denote for simplicity by $S(x,\theta)$, $S_x, S_\theta < 0$. The introduction of the start-up costs does not alter this value for given θ and x, so its solution is known from the preceding analysis.

Let the entrepreneur's optimal PDV of income when the decision is made to apply for a new company be Q. With discount rate r and the stationary policy variables a, c, s, this value satisfies the Bellman equation

$$rQ = -c + a(S(x,\theta) - s - Q). \tag{32}$$

The entrepreneur pays c per period until a permit arrives, which changes her state from Q to S, for a fee s. Solving (32) for Q gives

$$Q(a,c,s,\theta;x) = \frac{a}{r+a}S(x,\theta) - \frac{c+as}{r+a}. \tag{33}$$

Given knowledge of $S(x,\theta)$, $Q()$ is immediately obtained from (33) because r, a, c and s are all parameters.

Equation (33) implies that for given x and θ, the value of applying for a new firm falls in the costs c and s and rises in the arrival rate of the permit a (and so falls in the expected waiting time $1/a$). An x individual will apply for a new company if $Q(a,c,s,\theta;x) \geq U(\theta)$. Because $Q()$ falls monotonically in x, a reservation rule similar to the one in (14) is again satisfied. At the optimal R,

$$\frac{a}{r+a}S(R,\theta) - \frac{c+as}{r+a} = U(\theta). \tag{34}$$

Equation (34) can be represented in (R,θ) space as a downward-sloping curve similar to the entrepreneurship curve of figure 1, but now shifts down in the costs c and s and in the expected delay $1/a$. The start-up costs do not influence any of the other expressions in the derivation of equilibrium, because workers arrive and wage determination takes place after the company is set up and the costs paid.

The influence of start-up costs can be derived with the help of figure 2. They shift the entrepreneurship curve down and so reduce the fraction of the population who become entrepreneurs. Employment falls for two reasons. First, because entrepreneurs have higher employment rates than workers, the shift from managers to workers reduces employment. We refer to this as the composition effect of start-up costs. Overall employment is given by the sum of the number of managers and the aggregate employment of workers:

$$F(R) + n = \frac{\lambda F(R) + \theta q(\theta)}{\lambda + \theta q(\theta)}. \tag{35}$$

The composition effect is shown by a lower $F(R)$.

Second, with fewer entrepreneurs, job creation is lower, so fewer workers find jobs. We refer to this as the **job creation** effect of start-up costs. It is shown in (35) by a lower $\theta q(\theta)$.

Start-up costs reduce market tightness an so through (22) increase the expected profit from a new vacancy. This is an equilibrium response to the costs: new entrepreneurs have to pay the start-up costs and so need higher expected profit from new jobs to compensate them. The costs are borne by workers in the form of higher unemployment, lower wages and lower PDV of income of both employed and unemployed persons, implied by (20) and (29).

The number of jobs per existing firm, however, increases, because of the increase in the expected profit per job, as implied by (12) and (26). Start-up costs protect the incumbents, who now make more profit per job and create more jobs. But the market as a whole suffers, because the number of entrepreneurs now falls and there is less aggregate job creation. This is what Djankov et al. (2000) call the "grabbing-hand" view of regulation. Following Stigler's analysis of regulation, they argue that one of the reasons for regulation is to make entry more difficult and create rents for incumbents. Their second version of the "grabbing-hand", what they call the "tollbooth view" of entry costs, is also satisfied by the model. This is that the reason for start-up costs is for the politicians to collect revenue, which is represented in the model by the two cost variables c and s.[6]

Our model can also be used to analyze the impact of bribes. It is asserted by many (see again Djankov et al.) that entrepreneurs can pay bribes to speed up the arrival of permits for business start ups. Let the bribe be a payment p, made when the permit arrives (the analysis is similar if it is paid during the waiting period with no guarantee of a faster arrival). The bribe speeds up arrival by increasing the arrival rate $a : a = a(p)$, $a'(p) > 0$. Then (32) changes to

$$rQ = \max_p \{-c + a(p)(S(x, \theta) - s - p - Q)\}. \tag{36}$$

[6] Their first, Pigovian view, that regulation gives consumers a "helping hand" by ensuring that only good entrepreneurs start up is not in the model. They do not find evidence for it.

The optimal bribe increases in the expected payoff $S(x, \theta)$ and the recurring cost c but decreases in the fee s under standard restrictions.

5 Some preliminary evidence

Several factors related to policy have been identified as contributing to country differences in employment or unemployment rates. The problem that has to be confronted when considering the influence of company start-up costs is how to distinguish the influence of start-up costs from the influence of other related variables, given that a country that has a lot of regulation in company start-ups is also likely to have a lot of regulation elsewhere. My modest objective in this section is to look at some partial correlations between start-up costs and employment performance and at the relation between start-up costs and another much-researched regulation candidate, employment protection legislation.

In Table 1 I report two sources of data for start-up costs for major countries of the OECD. The first two columns report data gathered by Logotech and reported by Fonseca et al. (2001). Column (1) gives the number of procedures needed to register a company. A procedure is anything that has to be done in an office outside the company's premises, such as filling-in a form and submitting it for obtaining a VAT number. Column (2) gives the average number of weeks that lapse between the first application for a start-up and the first legal trading day. Column 3 combines these series into a single index. In order to compile the index, we first calculate how many procedures are on average completed within a week in the sample as a whole. We then divide the actual number of procedures that a country requires by the average and obtain a series that has the dimension of weeks, but which is a linear transformation of the number of procedures. Our index is the average of the actual number of weeks needed and the constructed series.

Columns 4-6 report data compiled by Djankov et al. (2000). Again, the first two columns report the number of procedures and the expected waiting time, in business days. Column 6 gives the expected cost as a percent of GDP per capita in 1997.

Although there are differences between the two data sources, the correlations is high. Table 2 reports correlation coefficients. The correlation between the two series for procedures is 0.64, which is almost identical to the correlation between the two series for waiting times (not reported in the

Table). The Table also reports the correlations between the start-up series and the OECD's index for employment protection legislation, which is representative of labor-market regulation. The correlation is positive and over 0.70 with all measures of start-up costs, indicating that countries with a lot of regulation of company start-ups also have a lot of labor regulation.

The correlations between employment-to-population ratios and the measures for start-up costs are better than the respective correlations with unemployment. The series compiled by Fonseca et al. (2001) give better correlations, which are in turn better than the correlations between employment and employment protection. Figure 3 shows the correlation between the index for start-up costs and the employment-to-population ratio (which is about the same as the one with number of procedures). The correlation is better than the one between employment and employment protection, shown in figure 4 (0.80 versus 0.60). figures 5 and 6 show the partial correlations between unemployment and the respective measures of regulation. again, although the fit is not as good as for employment, it is better with our index of start-up costs than with employment protection legislation.

Despite the correlation between start-up costs and employment protection, the partial correlations give encouraging results about the likely importance of start-up costs in the explanation of OECD employment performance.[7]

6 Conclusions

The motivation for this paper is very much that in Edmund Phelps' book Structural Slumps: the factors that can explain the differences in labor market performance across the OECD are "structural," and should be sought in the institutional structures of the countries. The factor discussed in this paper is one neglected by previous studies, the regulatory framework for the establishment of new companies. I have shown how the costs that governments impose on new entrepreneurs can give rise to differences in equilibrium employment rates, within a fairly standard model of equilibrium search with

[7] With only 17 observations not much more can be said at this stage. However, a simple regression of employment rates on the start-up index (or the number of procedures) and employment protection gives a significant result for start-up costs (t-statistic -3.25) but not for EPL (t-statistic -0.02), with an R^2 of 0.64. If the dependent variable is unemployment, the t-statistic on start-up costs is 2.75 and on employment protection -0.46, with $R^2 = 0.49$.

career choice. A preliminary examination of the data shows that there are large differences across the OECD in company start-up costs and that these costs are strongly correlated with employment performance. Of course, although lower costs of entering an activity in the labor market are obviously better than higher costs, this paper has nothing to say about the welfare aspects of regulation in business start-ups. Regulation is exogenous in the model and its implications for the labor market are the trivial ones of imposing some entry costs on new entrepreneurs. My purpose was to examine the extent to which the different entry costs imposed by governments across essentially similar economies have implications for the observed differences in labor market performance.

The next step in this research is a more general model of employment determination that can distinguish between the regulation of entry and other types of regulations. I have made a beginning in this paper by looking at labor regulation, in the form of employment protection legislation. Although the correlation between start-up costs and employment protection measures is positive and high, start-up costs appear to be better correlated with employment performance than is employment protection. The welfare aspects of different aspects of regulation and start-up costs also need to be examined before policy recommendations can be made.

References

[1] Blanchard, O. J. (1999). "European Unemployment: The Role of Shocks and Institutions." Baffi Lecture, Rome.

[2] Blanchard, O. J. and J. Wolfers (2000). "The Role of Shocks and Institutions in the Rise of European Unemployment: the Aggregate Evidence." Economic Journal 110, C1-C33.

[3] Bruno, M. and J. D. Sachs (1985). Economics of Worldwide Stagflation. Cambridge, Massachusetts: Harvard University Press.

[4] Burdett, K. and D. T. Mortensen (1998). "Wage Differentials, Employer Size, and Unemployment." International Economic Review 39, 257-273.

[5] Djankov, S., R. La Porta, F. Lopez-de-Silanes and A. Shleifer (2000). "The Regulation of Entry." Discussion Paper No. 1904, Harvard Institute of Economic Research.

[6] Fonseca, R., P. Lopez-Garcia and C. A. Pissarides (2001). "Entrepreneurship, Start-up Costs and Employment." *European Economic Review* 45, 692-705.

[7] Hosios, A. J. (1990). "On the Efficiency of Matching and Related Models of Search and Unemployment." *Review of Economic Studies* 57, 279-298.

[8] Layard, R., S. Nickell and R. Jackman (1991). *Unemployment: Macroeconomic Performance of the Labour Market*. Oxford: Oxford University Press.

[9] Lucas, R. E. (1978). "On the Size Distribution of Business Firms." *Bell Journal of Economics* 9, 508-523.

[10] Petrongolo, B. and C. A. Pissarides (2001). "Looking into the Black Box: A Survey of the Matching Function." *Journal of Economic Literature* 39, 390-431.

[11] Phelps, E. S. (1972). *Inflation Policy and Unemployment Theory: The Cost-Benefit Approach to Monetary Planning*. New York: Norton.

[12] Phelps, E. S. (1994). *Structural Slumps*. Cambridge, MA: Harvard University Press.

[13] Phelps, E. S. et al. (1970). *Microeconomic Foundations of Employment and Inflation Theory*. New York: Norton.

[14] Pissarides, C. A. (2000). *Equilibrium Unemployment Theory*. 2nd ed., Cambridge, MA: MIT Press.

7 Appendix

7.1 The social planner's problem

Let μ be a multiplier for the constraint in (4) and ν a multiplier for the constraint in (5). The Euler conditions for the controls $\alpha(x), R, \theta$ and the state n satisfied by the maximization of (3) subject to (4) and (5) are

$$-e^{-rt} x g'(\alpha(x)) + \nu = 0 \tag{37}$$

$$-e^{-rt}\left(Rg(\alpha(R)) + b\right) - \theta q(\theta)\mu + (\theta + \alpha(R))\nu = 0 \tag{38}$$

$$(1 - F(R) - n)\,(\theta q'(\theta)\mu + q(\theta)\mu - \nu) = 0 \tag{39}$$

$$e^{-rt}(y - b) - (\theta q(\theta) + \lambda)\mu - (1 - \theta)\nu + \dot{\mu} = 0. \tag{40}$$

Condition (39) implies

$$\nu = (1 - \eta)q(\theta)\mu, \tag{41}$$

where η is the absolute value of the elasticity of $q(\theta)$, not necessarily a constant but a number between 0 and 1. $xg'(\alpha(x))$ is the marginal cost of managing one more job for manager x and by (37) it is independent of x. We denote it by ϕ. In the steady state (37), (40), and (41) give the condition for market tightness, θ :

$$(1 - \eta)(y - b - \phi) - \eta\theta\phi - \frac{r + \lambda}{q(\theta)}\phi = 0. \tag{42}$$

Finally, (37), (38) and (41) give the condition for the reservation managerial ability

$$Rg(\alpha(R)) + b - \left(\alpha(R) - \frac{\eta}{1 - \eta}\theta\right)\phi = 0. \tag{43}$$

Table 1

Company Start-Up Costs, 1997-8

Country	**Procedures (1)**	**Weeks (2)**	**Index (3)**	**Procedures (4)**	**Days (5)**	**Cost (6)**
Australia	6.5	1	2.47	3	3	0.021
Austria	10	8	7.03	12	154	0.454
Belgium	7	6	5.12	8	42	0.010
Denmark	2	1	1.11	5	21	0.014
Finland	7	6	5.12	4	32	0.012
France	16	6	7.85	16	66	0.197
Germany	10	16	11.03	7	90	0.085
Greece	28	6.5	11.73	13	53	0.480
Ireland	15	3	6.04	4	25	0.114
Italy	25	10	12.57	11	121	0.247
Japan	14	3	5.74	11	50	0.114
Luxembourg	5	2	2.51			
Netherlands	9	12	8.73	8	68	0.190
Portugal	10	8	7.03	12	99	0.313
Spain	17	23.5	16.90	11	83	0.127
Sweden	7	3	3.62	4	17	0.025
United Kingdom	4	1	1.71	7	11	0.006
United States	3.5	1.5	1.81	4	7	0.010

Notes: Columns (1) and (4) give the number of procedures that a new company has to go through before starting operations. Column (1) is from Fonseca et al (2001) and column (4) from Djankov et al (2000). Columns (2) and (5) give the average length of time, in weeks and business days respectively, needed to complete these procedures. Sources as above. Column (3) combines the first two measures according to the formula (no. of weeks + no. of procedures/average procedures per week)/2. The average is computed as the ratio of the sum of procedures to the sum of weeks, so the index has the sample mean of weeks. Column (6) gives the expected financial cost as a percent of GDP per capita in 1997. Source, Djankov et al (2000).

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Table 2

Correlations

	Employment	Unemployment	Procedures1	Procedures2	Index
Unemployment	-0.82				
Procedures1	-0.81	0.56			
Procedures2	-0.49	0.28	0.64		
Index	-0.80	0.70	0.77	0.59	
EPL	-0.60	0.47	0.70	0.76	0.75

Notes: Employment is defined as the ratio of employment to population of working age in 1998, Unemployment is the standardized unemployment rate in 1998, Procedures1 is the series shown in column (1) of Table 1, Procedures2 is shown in column (4) of Table 1, Index is the index of start-up costs shown in column (6) of Table 1 and EPL is the OECD's index of employment protection legislation in the late 1990s.

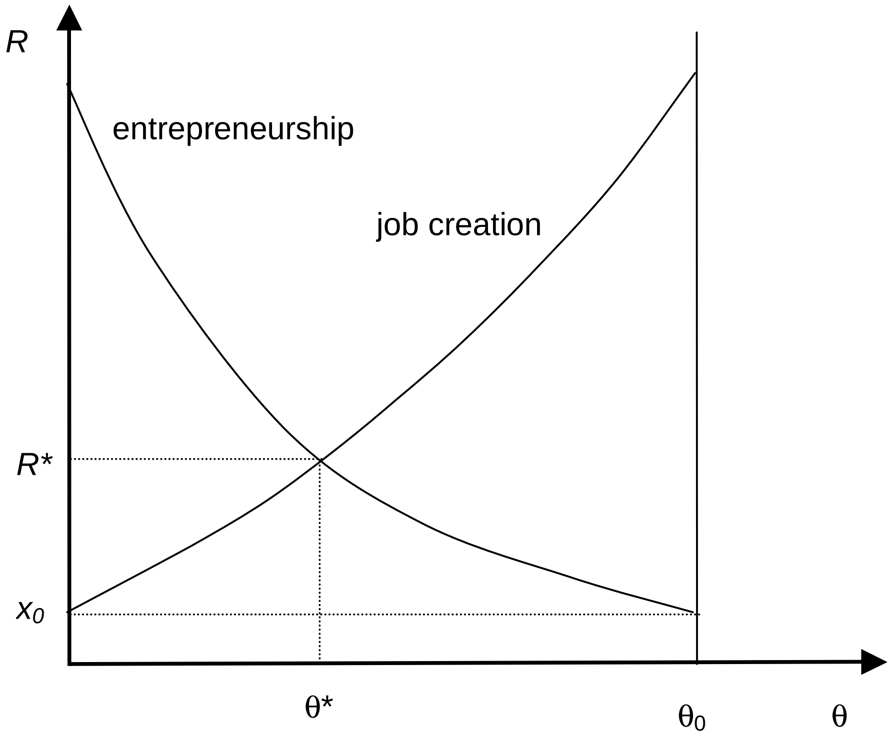

Figure 1
Equilibrium entrepreneurship and labour-market tightness

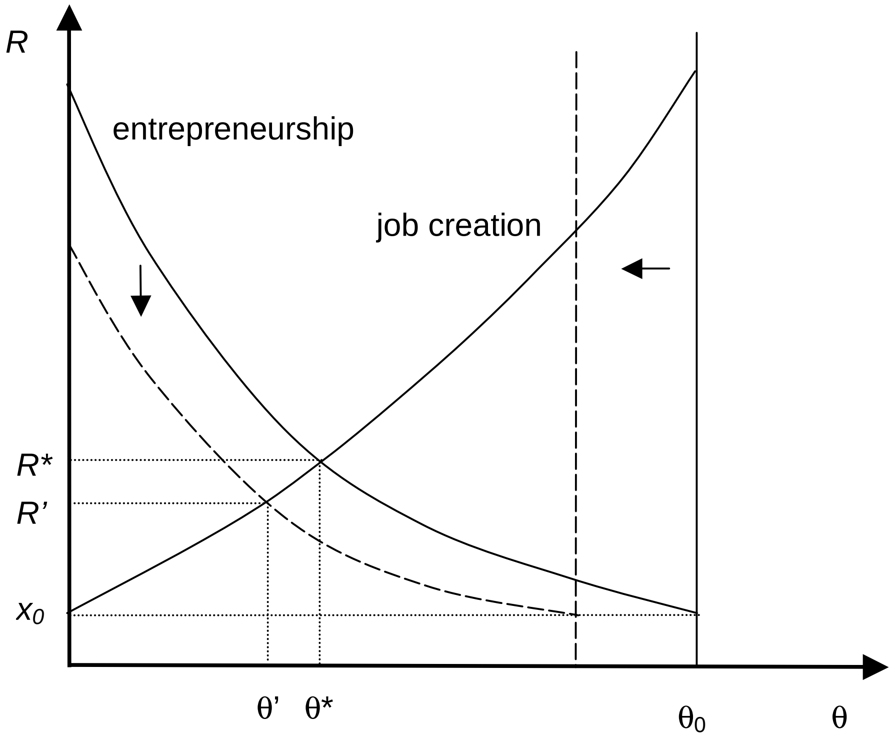

Figure 2
The effect of start-up costs on entrepreneurship and job creation

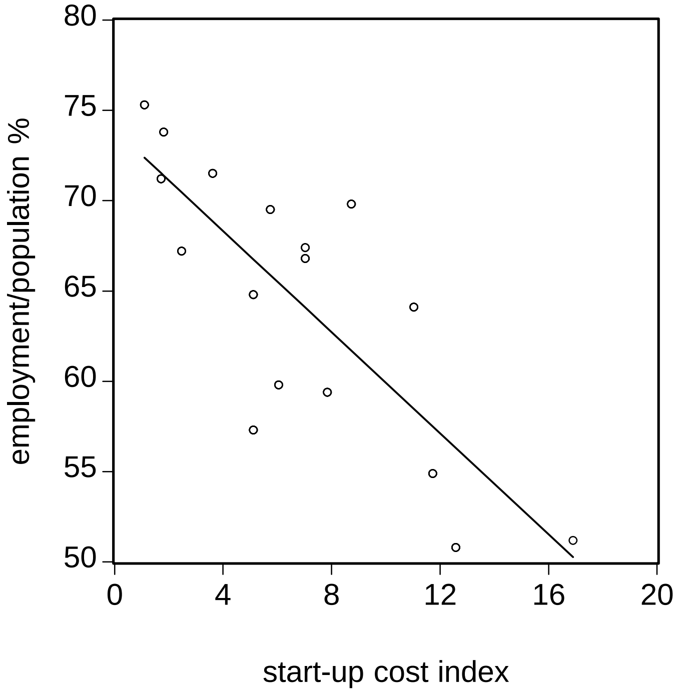

Figure 3
Start-up costs and employment, OECD, 1998

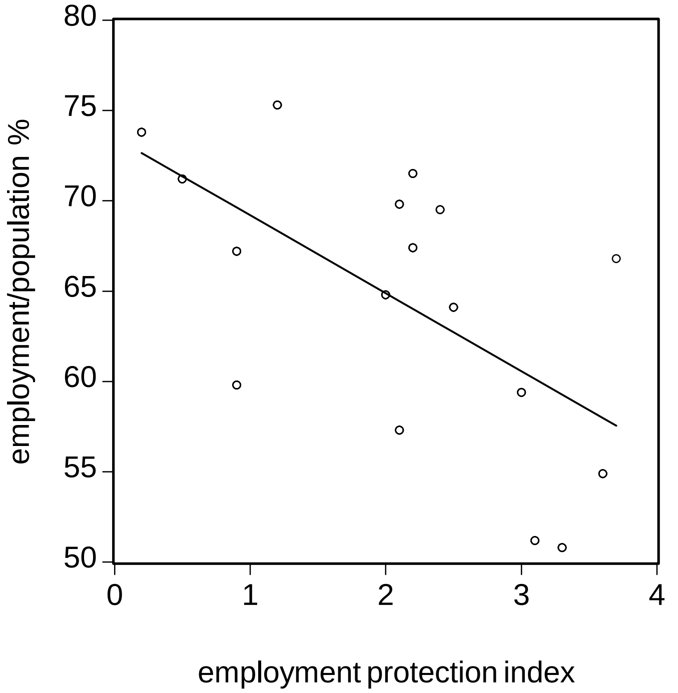

Figure 4
Employment protection legislation and employment, OECD, 1998

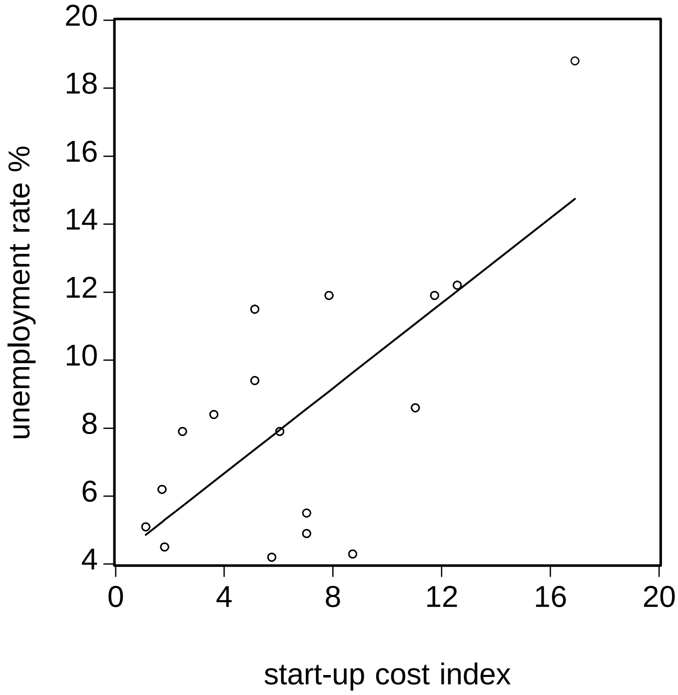

Figure 5
Start-up cost and unemployment, OECD, 1998

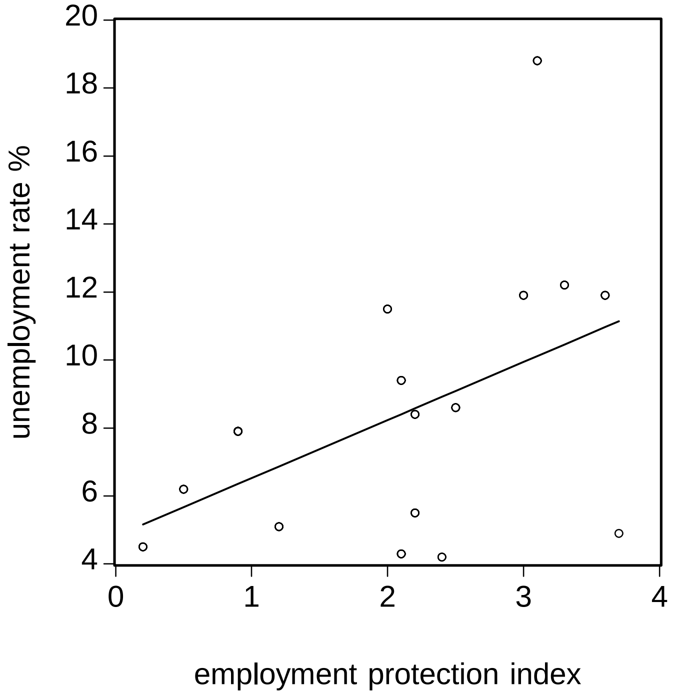

Figure 6
Unemployment and employment protection legislation, OECD, 1998