THE UNIVERSITY of York

Discussion Papers in Economics

No. 1996/46

Job Reallocation and Average Job Tenure:
Theory and Workplace Evidence from Australia

by

Karen Mumford and Peter N Smith

Department of Economics and Related Studies
University of York
Heslington
York, YO10 5DD

JOB REALLOCATION AND AVERAGE JOB TENURE: THEORY AND WORKPLACE EVIDENCE FROM AUSTRALIA*

Karen Mumford[1,2] and Peter N. Smith[1]

[1] Department of Economics
University of York

[2] Centre for Economic Performance
London School of Economics

First version 1996,
Revised September 1998

Abstract JEL # J6

We explore determinants of job reallocation and the implications for employment change and average job tenure in this paper. A model which associates technological advances with the process of economic growth is analysed and extended. A consequence of this model is that innovation leads to the creation of new jobs and the destruction of older jobs exhibiting obsolete technology. Data on average job tenure within workplaces and gross job flows across workplaces in Australia are constructed by us from a single panel of workplace data and examined. Substantial simultaneous job creation and destruction are found in a year of strong job growth, suggesting that workplace heterogeneity is an important feature of the Australian labour market. The predictions generated from the theoretical model are examined with the data for job flows and average job tenure. Our results support the key features of the model.

Keywords: labour market flows, job reallocation, creative-destruction, average-tenure.

* The authors are grateful for helpful comments and advice from Simon Burgess, Jonathan Haskel and Danny Quah; from seminar participants at the IFS and the Universities of Warwick, York, Glasgow, Manchester and Bristol; and from conference participants at the Australian Economic Society Meetings and the International Conference on Job tenure and Labour Reallocation (LSE). Responsibility for any mistakes or omissions is entirely our own.

I. Introduction

The empirical reality that the labour market is characterised by continuous flows of workers through jobs, across employment states and in and out of the labour force is now well documented for many countries (OECD 1994). In this paper[1] we concentrate on the flow of workers in and out of jobs as reflected in measurements of job creation and job destruction in the workplace (Davis and Haltiwanger 1990, 1992 and 1995, Davis *et al* 1996). Descriptive empirical studies of job flows are rarer than those of worker flows, although there is a study of manufacturing in Australia using disaggregated industry sector data (Borland 1996) and a limited number of studies for other countries are available (Contini and Revelli 1992, and CEPR 1995). Some multivariate empirical analyses of job flows have also been carried out resulting in a limited number of stylised facts, for example, employment change is associated: asymmetrically with positive and negative firm-specific demand shocks; with firm size and age; with the extent of product market competition; and with different industry groups (Blanchflower and Burgess 1996, and Davis *et al* 1996).

Papers which attempt a theoretical explanation of gross job flows in the labour market are even fewer in number. Amongst the most important of these papers is the partial equilibrium approach of Caballero and Hammour (1994) and the general equilibrium explanations provided by Aghion and Howitt (1994), Mortensen and Pissarides (1995) and Caballero and Hammour (1996). These papers all rely on economic growth resulting in a process of creative destruction which generates reallocation in the labour market.

A flexible theoretical model is needed to assess the relative importance of the above stylised facts in order to give them structural interpretations. A key feature of such a model is that it should allow the firm to control hiring of new workers and firing of existing workers separately. This will allow for the possibility of asymmetric behaviour when looking at the net change in employment. We employ the Caballero and Hammour (1994) model to form the core of our model structure. However, as we require a model capable of capturing a much wider range of structural characteristics than Caballero and Hammour (1994) consider, we extend it in a number of directions and discuss the empirical importance of each of these extensions. We can also consider the implied effects of the predicted job reallocation for average tenure levels in the

---

[1]This paper is based on our paper 'Job reallocation: theory and workplace evidence.' Centre for Economic Performance Discussion Paper No. 360, July 1997.

workplace.

We test the predictions of the model with respect to differences in job reallocation and average job tenure across workplaces using data generated by the Australian Workplace Industrial Relations Survey 1989 (AWIRS) from some 2000 workplaces. This data source provides important information on total job movements across workplaces in a year of substantial employment growth in Australia (the Australian Bureau of Statistics, ABS, measure of total employment growth was 5.6% for the year), allowing for the calculation of gross job flows. AWIRS respondents also provided information on a range of topics, resulting in a rich source of additional information used to test the predictions generated from the theoretical model.

In section 2 of the paper we consider the creative destruction models discussed above and develop a range of hypotheses we wish to explore empirically. Calculations of the gross job flows and a comparison of the size of these flows in the Australian labour market with respect to studies for other countries are discussed in section 3. The predictions of the model using our calculations of job reallocation rates and average job tenure are investigated in section 4 of the paper. Conclusions and suggestions for further work are presented in the fifth, and final, section of the paper.

II. Modelling job flows

Caballero and Hammour (1994) argue that the processes of job creation and destruction are profit maximising responses of firms facing continuously advancing technology and exogenous changes in the demand for their output. Firms are assumed to introduce new technology by creating a new production unit (a new job) which is a bonding of a suitable worker, capital and state-of-the-art technology. New workers are more productive and output will be accordingly higher. Once created, the technological level of a job is fixed, consequently a gap between the worker's productivity and that of new employees emerges over time. If firms do not introduce new jobs, their production processes will eventually become outdated as the skills of the longer tenured members of the labour force become relatively obsolete. When a recession hits, the derived demand for the firm's employees falls. The firm can reduce the size of its labour force by either decreasing job creation or increasing job destruction. If it adjusts entirely via less creation, the incumbent employees are, at least partially, insulated from the recession. The course chosen by the firm will depend on the nature of the costs involved in creation and the necessity to smooth this flow over time

Following Caballero and Hammour (1994), firms combine labour and capital in fixed proportions to create a new productive unit (a new job) which they endow with the latest technology. The exogenous continuous technological progress is such that the productivity of new units grows at a positive rate $\tilde{a}$ throughout time t. Once created, however, technology is embodied and the productive unit will produce a constant flow of output $A(t_0)$ over its lifetime, from time period t_0. At any particular point in time t, there will be a distribution $f(a,t)$ of jobs of ages a, such that $0 \leq a \leq a_m(t)$ and $a_m(t)$ is the age of the oldest job still in existence. Aggregating across jobs at any time provides total industry employment (of labour or capital stock in operation) $N(t) = \int_0^{a_m(t)} f(a,t)da$ and total industry output is given by

$$Q(t) = \int_0^{a_m(t)} A(t-a)f(a,t)da. \qquad (1)$$

There is a positive constant attrition rate $\ddot{a}$ which is exogenous. At any time t the number of jobs that have survived for a years is given by

$$f(a,t) = f(0,t-a)exp^{-\ddot{a}a}, \qquad 0<a\leq a_m(t). \qquad (2)$$

Differentiating $N(t)$ over time, and allowing for (2), provides the fundamental equation for employment growth:

$$\dot{N}(t) = f(0,t) - (f(a_m(t),t)[1-\dot{a}_m(t)] + \ddot{a}N(t)) \qquad \text{(A)}$$

The first term in equation (A) is the flow of creation of production units, $f(0,t)$. The second term is the total flow of destruction which consists of three parts: $f(a_m(t),t)$ units have reached their obsolescence age (a_m); changes in a_m over time lead to $-(f(a_m(t),t)\dot{a}_m(t))$ units being destroyed; and $\ddot{a}N$(t) units are retired due to attrition. The first two components of the destruction flow can be considered as endogenous flows. The third component $\ddot{a}N(t)$ is exogenous. Normalising the creation flow and the total destruction flow by $N(t)$ provides the job creation and job destruction rates, respectively. Average tenure in the firm across all units at a point in time t is:

$$\text{average tenure} = \frac{\int_{f(0,t)}^{f(a_m,t)} a(t).df(a,t)}{N(t)}$$

It will be positively affected by $a_m(t)$ and negatively by $f(0,t)$.

There may be a cost *c = c(f(0,t))* involved in creating a job. (We will return to consider some implications of creation costs later.) If we assume free entry in the industry, the firm will equate the creation cost to the discounted value of the expected profit flow generated by the job over its lifetime. If the operating costs of the job are set at 1, then the profits *ð* generated at time *t* by a production unit of age *a* are *ð(a,t) = P(t)A(t-a)*-1 where *P(t)* is the price of a unit of output and 1 denotes the operating costs of a production unit. Let *T(t)* be the maximum life of a production unit created at time *t*, with perfect foresight

$$a_m[t+T(t)] = T(t) \tag{3}$$

The free entry condition at any time *t* is

$$c(f(0,t)) = \int_t^{t+T(t)} ð(s-t,t)\exp^{-(r+ä)(s-t)} ds \tag{4}$$

where *r*>0 is the interest rate (exogenously given). A production unit is destroyed when its profits reach zero. Thus, $a_m(t)$ satisfies

$$P(t)A(t-a_m(t)) = 1 \tag{5}$$

A unit elastic demand function is assumed with $\overline{D}(t)$ being total spending on industry output

$$\mathrm{P}(t)Q(t) = \overline{D}(t) \tag{6}$$

In steady state, the cost of creation is given by[2]

$$c(f^*(0)) = \frac{\exp^{ãa_m^*} - \exp^{-(r+ä)a_m^*}}{ã+r+ä} - \frac{1-\exp^{-(r+ä)a_m^*}}{r+ä} \tag{7}$$

and the creation flow is[3]

$$f^*(0) = \frac{(ã+ä)\overline{D}}{\exp^{ãa_m^*} - \exp^{-äa_m^*}} \tag{8}$$

When the creation cost is constant (independent of the creation flow), a_m^* can be found from (7). This value for a_m^* can then be incorporated into (8) to find the creation flow given the level of demand. These analytical solutions are not very informative, however, we can easily

---

[2]To find (7), solve (4) after substituting *P(s)A(t-a)* -1 for *ð(s,t)* and expanding, remembering that in steady state $T(t)=a_m(t)=a_m^*$, that prices are falling at the rate *ã* and technology between *a*=0 and $a=a_m^*$ will have risen by $exp(ãa_m^*)$.

[3]Substitute for Q_t in equation (6) making use of equation (1) and that in steady state *f(a,t)* = $f^*(a)$ for all t, so $f^*(a) = f^*(0)exp(-äa)$, prices and technology are treated similarly as when solving for (7).

substitute in values for the parameters[4] and obtain calibrated solutions. For example, if we assume that r=0.065, $\ddot{a}$=0.15, $\tilde{a}$=0.028 and c=0.5, we find a_m^* from (7) to be 7.3 years, substituting this value into (8) and assuming that $\bar{D}$=1 provides a creation flow of 20.1% per annum.[5] Outside of steady state, providing $c'(f(0,t))$=0, the system retains its recursive property so that if we double the cost of creation to c=1, *ceteris paribus*, we find a_m^* increases to 11 years and creation flow falls to 15.2%. If the creation cost is allowed to vary with the creation flow $c'(f(0,t))$>0, the system must be solved simultaneously. Nevertheless, the path $\{f(0,t), a_m(t), T(t), P(t), Q(t)\}_{t\geq 0}$ satisfying equations (2), (A) and (1) to (6) for all $t\geq 0$, given an initial density of $f(a,0)$, a>0, of production units provides an equilibrium for this industry and determines the right-hand side of equation (A) for employment change.

Caballero and Hammour (1994) go on to explore the implications of demand shocks for their model over the longer run (over phases of the business cycle between 1972 and 1984). They provide empirical evidence from US data which supports an asymmetric response of job creation and destruction to output shocks. In this paper we are more interested in the implications of the model for employment changes across a single time period and for expected average job tenure. In particular, we will present an empirical investigation of equation (A) above, the dynamic equation for employment. To do this successfully, however, we need to develop the structure of the model to incorporate a number of features which may be of empirical importance.

Demand shocks and creation costs

When industry demand $D(t)$ falls, the firm can either reduce the flow of creation of new jobs $f(0,t)$ or it can increase the endogenous destruction flow (by reducing the age at which redundancy occurs, $a_m(t)$). If the firm fully insulates incumbents by adjusting entirely through a fall in creation, the firm will have to undergo more rapid creation in future time periods to maintain a competitive level of productivity. If there is no association between the costs of creation and the extent of the creation flow, $c'(f(0,t)) = 0$, then the firm will indeed fully insulate[6] in the recession thereby

---

[4]By providing values for the interest rate (r), the attrition rate ($\ddot{a}$), the rate of technological growth ($\tilde{a}$) and the creation cost (c).

[5]The values for these parameters are set equal to the values chosen by Caballero and Hammour (1994) for comparisons sake.

[6]If $c'(f(0,t)) = 0$ and the parameters are set equal to that discussed above, a shift in demand from 0.5 to 1 to 2 has no impact on the redundancy age (it remains at 7.22 years) whilst the creation flow increases from 10% to 20.1% to 40.2%.

temporarily saving itself the set up costs involved in creation, *c*. Thus the firm will lower employment by taking on fewer new hires. Since the retirement age is not changing, the expected job tenure of an individual remains the same, however, if the firm lowers the creation flow the average job tenure in the workplace will rise *ceteris paribus*.

It is quite possible, however, that there is a positive relationship between the creation rate and the costs of creation such that $c'(\cdot)>0$. For example, attracting new employees requires successful matching and there may be diminishing returns in the matching function, there may also limits to the resources available for the training of suitable applicants, similarly the availability of capital needed to bond with labour in the new job may be limited in any time period. Consider the case where creation costs are linear and of the form $c=c_0+c_1\, f(0,t)$, then in general, holding c_0 constant and increasing c_1 has the effect of raising a_m^* whilst lowering $f(0,t)$.[7] The stronger the relationship between the size of the creation flow and the costs of creation, the smaller the insulation effect will be. Firms will respond by trying to smooth the creation of jobs over time and business cycles, and falls in demand in a recession will be accommodated via an increase in destruction (by lowering the redundancy age) as well as lowering the creation flow[8]. In other words, firms will make adjustments on both margins leading to lower employment and contrary effects on average tenure. In the extreme, when the marginal creation cost is very high, firms will set a constant creation rate whilst accommodating the business cycle by varying redundancy age. Empirically, however, we would expect and indeed we find that firms appear to operate on both margins.

Workplace age and job reallocation

We have argued that newer jobs are more productive and less likely to be made redundant. Analogously, younger firms will have a greater proportion of new jobs and experience less adjustment through destruction (Caballero and Hammour, 1994; footnote 22). It would seem, however, that this outcome would depend on the nature of creation costs the firm is facing. Empirically, a negative relationship between the age of the firm and job reallocation has been established in the literature (Davis and Haltiwanger, 1995). Caballero and Hammour add that their

---

[7]If we compare the cases where c_0=0.4 and c_1=0.5 with c_0=0.4 and c_1=0.95, we find values for a_m^* and $f(0,t)$ of 7.2, 20.9% and 7.9, 18.9% respectively.

[8]If we consider the case where c_0=0.4 and c_1=0.5, with other parameters remaining constant except for D, we find D=0.5 associated with a_m^* = 6.8 and $f(0,t)$=10.5%, at D=1 a_m^* = 7.2 and $f(0,t)$=20.9% and at D=2 a_m^* = 7.95 and $f(0,t)$=37.6%.

prediction could be considered more formally by assuming that the exogenous destructive flow due to attrition $\ddot{a}N(t)$ is made a decreasing function of age, $\ddot{a}(a)$. We introduce the term $\ddot{a}/a$ for attrition as a simple example. Solving for the steady state provides:

$$c(f^*(0)) = \frac{\exp^{\tilde{a}a_m^* - \ddot{a}} - \exp^{-ra_m^* - \ddot{a}}}{\tilde{a} + r} - \frac{\exp^{-\ddot{a}} - \exp^{-ra_m^* - \ddot{a}}}{r} \qquad (7a)$$

and

$$f^*(0) = \frac{\tilde{a}\bar{D}}{\exp^{\tilde{a}a_m^* - \ddot{a}} - \exp^{-\ddot{a}}} \qquad (8a).$$

It is perhaps not obvious from the above what difference this modification has made. As a comparison, we solve (7) and (7a) for a_m assuming in both cases that r=0.065, ä=0.15, ã=0.028 and c=0.5. We find that the obsolescence age falls from 7.2 years to 6.7 years if attrition falls with age according to $\ddot{a}/a$. Substituting these values for a_m into (8) and (8a) respectively, and assuming that D=1, we find creation flows accordingly fall from 20% to 15.8% in the steady state. If the obsolescence age and the creation flow have both fallen, employment will fall. We expect, therefore to find a negative relationship between workplace age and net employment change, the impact on gross employment change is not clear.[9] Similarly, a fall in the creation flow will increase average job tenure whilst a fall in the redundancy age will lower average tenure: the impact on average tenure is also not clear.

Training

Caballero and Hammour (1994) also briefly (in the conclusion) consider the possibility of a range of productivity within a cohort (perhaps reflecting differences in ability) and/or the existence of a learning curve so that units become wiser with age. These additions are, however, somewhat *ad hoc* to their model. Aghion and Howitt (1994; 489) explicitly consider the possibility of production units steadily increasing their output throughout their lifetime if they engage in a process of learning-by-doing. They argue that a production unit could increase its productivity according to learning-by-doing by some rate (say at some constant proportional rate $\tilde{a}_1$). In terms of the Caballero and Hammour framework, the technology of a productive unit once created is no longer constant over its lifetime, rather, productivity will be related to the age of the unit $A(t_0, a)$, where $A(t_0,a) = A(t_0)exp(\tilde{a}_0 + {}_1a)$. If the overall growth in technology incorporates this learning-by-doing effect then $\tilde{a}=\tilde{a}_0+\tilde{a}_1a$ where $\tilde{a}_0, \tilde{a}_1, \tilde{a}_1' > 0$. This will impact on the steady state condition:

---

[9]We could expect this to be a sizable impact considering the multiple impacts on the destruction flow of the fall in a_m and the substitution of $\ddot{a}/a$ for $\ddot{a}$ in the employment equation (A).

$$c(f^*(0)) = \frac{\exp^{ã_0 a_m^*} - \exp^{-(r+ä)a_m^*}}{ã + ã_1 + r + ä} - \frac{1 - \exp^{-(r+ä)a_m^*}}{r+ä} \tag{7b}$$

and

$$f^*(0) = \frac{(-ã_0 + ã + ä)\overline{D}}{\exp^{ã_0 a_m^*} - \exp^{-ä a_m^*}}. \tag{8b}$$

If we consider the case where training adds to total growth, for example $ã_0=0.028$ and $ã_1=0.003$ *ceteris paribus*, and compare our results with the standard model, (7) and (8), we find that the obsolescence age has risen (from 7.2 to 7.7 years) and the creation flow has fallen (from 20.1 to 18.96%).[10] If the obsolescence age has risen, destruction has fallen and net employment will rise. A fall in the creation flow will, however, lead to a fall in net employment. It is not clear which of these effects will dominate. The fall in creation flow and increase in the redundancy age will both lead to longer average job tenure, however. We will consider the relationship between measures of the impact of training, average tenure and employment changes in section 4 below.

An alternative view of the impact of training is presented in Mortensen and Pissarides (1995), they argue that firms can take an alternative option to destroying an unprofitable job and creating an entirely new job. Firms can keep their otherwise obsolete worker by retraining and combining with current capital to form a new production unit. In so doing, the firm can save itself the costs and uncertainties involved in the hiring process. (It may also gain by keeping the learning-by-doing productivity bonus inherent in longer tenured employees discussed above.) It could be argued that this is a simple result that merely arises from the definition of job creation used in the model. It is true that in both the Caballero and Hammour (1994) and Aghion and Howitt (1994) models the possibility of combining an old worker with new technology is not allowed for, and it would be a very simple process to incorporate this possibility within the Caballero and Hammour framework. Indeed, the retrained worker is actually occupying a new job with a new capital endowment and state-of-the-art technology and his/her previous job has been destroyed. Since this process of reallocation occurred within the same firm, however, employment levels have not changed. In the longer run, these firms can extract a larger return from an initial hire outside of the firm: they can create further jobs at a lower cost because they can retrain and make use of their incumbent workforce. As discussed previously, lowering the cost of creation will lead to a fall in the obsolescence age (lowering net employment) but an increase in job

[10]If we consider the case where $ã_0=0.025$ and $ã_1=0.003$, so that the total growth rate ã remains at 0.028 *ceteris paribus*, and compare our results with the standard model, (7) and (8), we find larger effects of the same direction: the obsolescence age rises (from 7.2 to 8.8 years) and the creation flow falls (from 20.1 to 17.9%).

creation (raising net employment). Note, the impact of training is slightly different if it acts to increase the productivity of the production unit (discussed above) than if it acts via lowering the creation cost. With an increase in productivity the redundancy age will rise and creation flow will fall (increasing average tenure), the opposite happens with a fall in creation costs (decreasing job average tenure), whilst both result in offsetting effects on total employment. We will explore the alternative relationships with training in the results section below.

It might seem that it would always be cheaper for a firm to retrain an incumbent worker than to seek and train a new employee from outside. This is not necessarily true, for example, if the job required skills of a general nature, the employer may prefer an outside candidate who has recently finished an education programme with more current skills. Alternatively, if the job required high levels of job-specific training (such as may occur if the firm used a capital intensive production process) the value of a successful match would be more important and the firm would be less willing to part with an incumbent (we also argue that a young workforce, *ceteris paribus*, will have less job-specific training). A third scenario may occur if the human capital component of the job is very little, in which case the firm could again save hiring costs by keeping an employee providing they had a similar opening to slot them in to. We could also expect large firms (with more openings at any point in time) to be more able to accommodate in this way and have less creation costs. We consider the relationship between measures of employee skills, capital intensity, young workforce, and workplace size for employment change and average job tenure and investigate the importance of these issues in section four of the paper,

Wage changes

Caballero and Hammour (1994) assume a constant consumption wage, implying that newer workers do not receive higher wages and that workers do not have bargaining strength over wages. The first is an intuitively unappealing assumption given that all workers from the same cohort have equal productivity and see their relative productivity fall at the same rate, $\tilde{a}$, compared to newer cohorts. Indeed, both Aghion and Howitt (1994) and Mortensen and Pissarides (1995) allow for the wages of more recent units to rise over time. Relative wage changes play an important part in the reallocation process in the general equilibrium models: workers are aware that they can earn more by being hired in a new production unit, they are therefore constantly seeking a new appointment. If firms do not raise the wages of their incumbent employees, they will lose these members of their workforce. This means that the wages of incumbent workers increase even though their productivity is set at the time of creation. The increase in wages will eat into the operating surplus causing the value of the job to depreciate at a faster rate and decreasing the obsolescence age. Whilst Caballero and Hammour do not discuss wage increases, their exogenous destruction rate *ä* can encompass this effect. We can consider this impact in (4') below:

$$c(f(0,t)) = \int_{t}^{t+T(t)} ð(s-t,t)e^{-(r+ä)(s-t)+bs}ds \qquad (4')$$

The integrand has changed between 4 and 4' due to the introduction of the factor e^{bs} which captures the depreciation due to wage movements. Solving for the steady state provides:

$$c(f^*(0)) = \frac{\exp^{(ã_0+b)a_m^*} - \exp^{-(r+ä-b)a_m^*}}{ã_0+r+ä} - \frac{1-\exp^{-(r+ä-b)a_m^*}}{r+ä-b} \qquad (7c)$$

and

$$f^*(0) = \frac{(ã_0+b+ä)\overline{D}}{\exp^{(ã_0+b)a_m^*} - \exp^{-äa_m^*}} \qquad (8c).$$

If we assume that wages increase by 1% per annum (b=0.01) and we maintain all the assumptions we have previously made about the remaining parameters, we find that (compared to the standard model as expressed in (7) and (8)) $a_m(t)$ falls from 7.22 years to 5.9 years whilst *f(0,t)* rises from 20.1% to 22.4%. These will once again have offsetting effects on employment change, an increase in the wage will lower the obsolescence age, increasing destruction and decreasing net employment whilst an increase in the creation rate increases net employment. Both of these effects will lead to lower levels of average job tenure. We consider the relationship between relative wages and employment changes in section 4 below.

Bargaining strength

Workers and firms may also share the operating surplus according to their relative bargaining strength *â*:

$$c(f(0,t)) = â \int_{t}^{t+T(t)} ð(s-t,t)e^{-(r+ä)(s-t)}ds \qquad (4'')$$

If workers have no bargaining strength, *â* = 1 and equations 4 and 4'' are equivalent. As the worker's bargaining strength increases, however, the period of profitable employment needs to rise in order to justify the original expenditure on creation. As *â* falls from 1 to 0.75 to 0.5, obsolescence age rises from 7.2 to 8.6 to 11 years and the creation flow falls from 20.1% to

17.9% to 15.2%. This is again an offsetting effect on employment change, union bargaining strength is positively related to a rise in obsolescence age (more employment and longer tenure) whilst negatively related to job creation (less employment but greater average tenure). We explore this relationship in section 4 below using two indicators of relative bargaining strength which we believe to be related to $\hat{a}$: union recognition and competition in the product market (Mumford and Dowrick, 1994). We expect that union recognition in a workplace would lead to a lower level of $\hat{a}$. Similarly, firms who face little competition may be less responsive to market pressures, resulting in lower level of $\hat{a}$. We consider this relationship in the results section after first establishing some basic features of the gross job flows data in section 3 below.

III. The size of the gross job flows

In this section of the paper we seek to establish some basic facts about the extent of job creation and job destruction occurring at surviving workplaces in Australia between September 1988 and September 1989. To establish comparability of this data with that used for other countries, the approach used here follows that proposed by Davis and Haltiwanger (1990 and 1992) investigating gross job flows in US manufacturing and is comparable to recent applications to the UK (Konings, 1995) and to a range of European countries (Burda and Wyplosz, 1994). As in Davis and Haltiwanger (1992), the size of an establishment *e* at time *t* is the average of the reported employment levels *n* in that establishment at time *t* and *t-1* and is denoted by $x_{et}=(n_t + n_{t-1})/2$. The growth rate for this establishment at time *t* (g_{et}) is the difference in employment levels at the establishment between *t* and *t-1* divided by x_{et}. Thus, $g_{et}=(n_t - n_{t-1})/x_{et}$. Using the average employment change in the denominator binds g_{et} to lay between -2 (a death) and +2 (a birth)[11].

We use data generated by the Australian Workplace Industrial Relations Survey (AWIRS) which interviewed some 2000 workplaces, with more than 20 employees, across all industries (excluding agriculture and defence), in September 1989. Respondents were asked for current employment information in September 1989 and for retrospective employment information of September 1988.

Figure 1 represents the weighted growth rate distribution for the 1678 workplaces in our

[11]A more commonly used growth measure (*G*) is the change in the variable over time divided by the lagged value of the variable, *G* and the measure used here (*g*) can be easily compared since $G \equiv 2g/(2-g)$. Thus when we consider a workplace growth rate of g = 0.15 this corresponds to the more standard measure of G = 0.1622, or some 16%.

data set, where the weights are the inverses of the sampling probability. The distribution is slightly asymmetric with the central peak laying just to the right of zero, as we would expect for a period of job growth. The bulk of workplaces lay close to the centre, indeed 75.8% of workplaces had growth rates which lay in the interval -0.15 to 0.15 and 42.3% lay between -0.05 and 0.05. This suggests that the vast majority of job reallocation and worker turnover is taking place in those workplaces experiencing only moderate changes in growth rates. If we concentrate on manufacturing, we find 36.9% lie between -0.05 and 0.05, with 70.8% lying between -0.15 and 0.15. The results are similar to those established for US manufacturing by Haltiwanger and Davis (1992) who found 29% and 63% respectively.

For this comparison the data set is limited by only considering workplaces still in existence on the interview date and thereby ignoring births and deaths. Comparing the original ABS list of possible participants with those selected for the survey suggests a simple death rate of 5.94%. Unfortunately, we cannot be more specific about the distribution of these deaths across industries nor about the size of the workforces involved and so cannot calculate a weighted death rate. Ignoring workplaces that have died will lead to an underestimate of job destruction, our measure should therefore be considered as a lower bound. The data set also provides inadequate information about new workplaces (less than one year old) and so will underestimate births and the true extent of job creation. It is possible, however, to make some allowances for births. The most extreme allowance we can make is to include all those workplaces with a missing observation for employment in 1988 and a positive employment level for 1989 as a birth (ie., set the employment level for 1988 equal to zero). This assumption increases the total number of observations by 69, from 1678 to 1747: births have increased substantially from 0.4% of all workplaces to 4.8%. We believe that this assumption will over predict the number of births in the economy as many of these missing observations are simply that. Nevertheless, the true gross flow measurement will sit between the adjusted and unadjusted series. Even with the extreme assumption, however, the percentage measure of workplaces laying in the intervals discussed above changes very little (40.5% lay between -0.05 and 0.05 and 75.8% lay between -0.15 and 0.15). These results support our conclusion that the majority of job turnover is taking place in surviving firms who are experiencing modest changes in their growth rates.

We can move readily from the measures of growth rates discussed above to consider gross job reallocation. Following Haltiwanger and Davis (1992), the gross job creation rate at time t

(pos_t) is the sum of the growth rates (or employment gains) at expanding or new workplaces divided by sector size (and suitably weighted), and vice versa for the gross job destruction rate (neg_t). The total reallocation of jobs in the economy (*gross*) is the sum of job creation and the absolute value of job destruction, whilst the net change (*net*) is the sum of creation and destruction. Table 1 lists these rates for the unadjusted and adjusted series by industry and total. The final column records the net employment change by industry for the Australian economy according to the ABS. Thus, considering the total values (the final row on the table), the unadjusted data suggests that there was an increase in the body of jobs due to job creation of 6.3% whilst simultaneously 5.2% of jobs were destroyed, this implies that 11.5% of jobs change and that after adjusting to accommodate these changes the economy's workforce increased by 1.1%. The adjusted series provides substantially larger measures of job creation (10.1%), total reallocation (15.2%) and net employment change (5%). The latter value sits much closer to the ABS calculation of a net employment growth rate of 5.6% for this time period, however, due to the lack of deaths in our data we believe these values to be overestimated[12].

Konings and Pissarides (1994) provide a comparison of job reallocation rates for the manufacturing sector in a range of different countries, they find (ignoring births and deaths) gross reallocation rates of about 15% per annum in North America and 10% in the EU. Our result of 11.4% reallocation in manufacturing (with no adjustments made for births) suggests that Australia sits in between Europe and North America, although it is closer to the former than the latter. This result is confirmed by comparing the gross reallocation rate calculated from WIRS for manufacturing in the UK in 1990 (without adjustment) of 9.8% (Konings and Pissarides, 1994;5).

We also find substantial variation across industries using both the adjusted and unadjusted series, with all industries showing substantial simultaneous job creation and destruction. Studies of job reallocation outside of manufacturing are rare, however, Anderson and Meyer (1994;220) provide reallocation rates for a range of American states by industry groupings. They also find substantial variation in simultaneous job creation and destruction across industries. There are some major definitional differences across the two studies, for example agriculture is not included

[12]We would also expect measures generated from ABS data to differ from those from the AWIRS data set we used because the latter does not consider workplaces with less the 20 employees. Our theoretical discussion suggests that small workplaces will be associated with higher job reallocation and thus that the ABS measures would be higher. We will explore the relationship between workplace size and employment change more fully in section 4 of the paper.

in the Australian data. The source of their data set is also very different; they use data from 1978 to 1984 collected from unemployment insurance records. Nevertheless, considering the industries included in both studies, the gross job reallocation ranking by industry is surprisingly similar (with construction and wholesale and retail trade all showing strong reallocation rates in both studies). Furthermore, manufacturing has comparatively low gross reallocation rates in both studies (7th out of 11 industries in Australia and 6th out of 10 industries in the US).

It is also useful to consider the extent of job reallocation relative to worker reallocation. Our aggregate adjusted job reallocation rates (total row, Table 1) reveal that 15.2% of jobs were either created or destroyed between the accounting periods of September 1988 to September 1989 in Australia. At a minimum, we would expect an increase in the number of workers to fill the net 5% growth in jobs, in fact worker reallocation rates are much higher than this since workers obviously change jobs and employment status for many reasons besides just demand from firms. Following Davis and Haltiwanger (1992 and 1995) a measure of worker reallocation can be constructed from the sum of (a) those people who have job tenure of 12 months or less in September 1989 and (b) those people unemployed in September 1989 who were employed in September 1988, both as a proportion of employment. This measure captures those people who have been in obvious transition in the previous 12 months. These values for worker reallocation are (a) 27.9%, (b) 5%, and a total of 32.9% for Australia (Davis and Haltiwanger, 1992, found 28.2%, 8.6% and 36.8% respectively for a typical year in the US between 1968 and 1987). Dividing gross job reallocation by worker reallocation provides the proportion of worker movements linked to changes in the employment patterns of workplaces. Thus, gross job reallocation is associated with some 46.2% of worker reallocation in Australia (Davis and Haltiwanger, 1992, found a similar upper limit of 56%).

IV. Explaining job reallocation and average job tenure

In this section of the paper we investigate the determination of differences in job reallocation and average job tenure across workplaces in Australia. To truly capture job reallocation we would like to measure simultaneous job creation and destruction at a workplace. We do not have these data, instead we can measure total net employment growth at a workplace (this captures the directional effect of demand changes predicted in our earlier discussion) or the absolute change in employment at a workplace (this measure effectively captures relative changes in reallocation) as measures of job reallocation. In the first case, we measure the difference between job creation and job destruction; in the second, the sum of absolute creation and destruction. In addition, we have a measure of the average tenure of employees at a given workplace for which our model generates predictions.

Table 2 presents our estimation results. In columns 1 and 2, the dependent variable is the net employment growth rate which is defined as the change in the logarithm of employment occurring in a workplace between September 1988 and September 1989[13] . We consider only continuing workplaces over this time period. In columns 3 and 4, the dependent variable is the absolute change in the logarithm of employment. In columns 5 and 6, the logarithm of average tenure is the dependent variable. Estimation is by generalised least squares and coefficient standard errors are calculated to be robust to heteroscedasticity in the equation error of an unknown form. Each of the first four models explains about 10 to 12% of the variation in net and 5 to 7% of absolute log employment change which, although small, is representative of this type of equation. We explain about 37% of the variation in log average tenure which is large given that we only model the demand side of the tenure decision. Encouragingly, the coefficients all have the signs suggested in our theoretical discussion (section 2, above) and we discuss them in turn below.

The fundamental relationship predicted by the Caballero and Hammour (1984) model is that an increase in the demand for a firm's output will lead to positive employment growth whilst a decrease in demand of the same size will lead to a stronger fall in employment. We investigate this prediction by including two binary variables: *demand up* and *demand down.* Respondents were asked if 'the demand for your workplace's main product or service is expanding, stable or contracting'. Demand up was coded to be 1 if the response was expanding and zero otherwise, similarly demand down was -1 for contracting and zero otherwise. Examining columns 1 and 2, our results support the idea of asymmetry, we find significant contrary effects of demand expectations on employment growth, we also find that the effect of a fall in demand is significantly larger than the impact of a rise in demand. According to columns 5 and 6, increased demand leads to reduced average tenure (although not very significantly). In terms of our model this implies that a substantial amount of the employment increase is achieved by increasing the creation flow. Downward adjustment of employment is also importantly generated by reducing the creation flow

[13]Thus we are not using the bounded measure used by Haltiwanger and Davis (1992) and in our Figure 1.

according to our results. The three sets of estimates, taken together, suggest that employment adjustment is achieved by both changing the creation flow and the obsolescence age (implying that there is an increasing relationship between the creation costs and the creation flow rate): the adjustment of the creation flow is proportionally large enough to determine changes in the average tenure.

Our second major hypothesis was that workplace age would have a negative impact on net employment growth, which is also supported by our results (where workplace *age* is a discrete 6 valued variable measured at the midpoints of each time period). The model solution in section 2 suggests that higher workplace age would be associated with reduced job creation and higher job destruction, thus reducing net employment growth. The effect on absolute employment change depends on the relative size of these two changes. Our results in column 3 show that the impact on reduced job creation is the greater. This is confirmed by the positive impact of age on average tenure in column 5. We investigate the structure of the impact of workplace age in more detail in columns 2, 4 and 6 by using dummy variables for age bands. Relative to a medium-aged workplace of 10-20 years (the missing category), we find that very young (age less than 2 years) workplaces experience substantially more net employment change. This is mirrored, although less significantly, in absolute change. Average tenure is substantially higher in workplaces over 10 years old. The effects on tenure proposed in our model are probably reinforced by institutional features such as well-developed industrial relations procedures in older firms.

The impact of training on employment change is captured by the variable *new train*ing (coded 1 if new training programmes have been introduced in the workplace, and 0 otherwise). Discussion of the effect of training in section 2 above concerns two alternative explanations. Both the learning-by-doing and the reduced creation cost arguments predicted offsetting impacts of training on employment growth. They have distinct predictions, however, for the impact on absolute employment change. We find a significant positive impact on net employment, suggesting that either the negative effect on the creation flow is outweighed by the positive impact on obsolescence age as suggested by the learning-by-doing approach or that the positive effect on the creation flow outweighs the negative impact on outflows as suggested by the reduced-creation cost argument. Firms who introduce training increase employment by 4% *ceteris paribus*. The effect of training on absolute employment change is downwards according to the learning-by-doing approach and upwards according to the reduced creation cost argument. The results in columns 3 and 4 support the learning-by-doing approach. The average tenure results also support the learning-by-doing approach by suggesting that training increases tenure, although both results are at modest levels of significance.

We argue above that relative wage change would have contrary effects on net employment change. We include a measure of the relative non-managerial wage of a workplace compared to other workplaces in the industry (a 5 valued discrete variable symmetrically coded around 0, *rel wage*). This wage measure is found to have a significant positive effect on workplace employment growth, suggesting creation is more substantially increased than destruction. Absolute employment change and average tenure are also significantly positively affected. The positive effect of the relative wage on average tenure is not consistent with our model, although it clearly is with models explaining employee labour supply decisions (Killingsworth, 1983) and on-the-job search activity (Mortensen, 1986).

The impact of bargaining over the firms' surplus on employment change is modelled through measures of union activity and product market competition. *Union recognition* (a binary variable coded 0 if the workplace is not unionised and 1 if it is) and the level of *competition* (a discrete 3 valued variable for none=3, few=2, or many=1 competitors) facing the workplace in the output market were included to reflect relative bargaining strength. In the presence of union recognition, the firm's relative bargaining strength, $\hat{a}$, would fall and *vice versa* with increased product market competition [14]. We expect changes in $\hat{a}$ to have contrary impacts on employment growth as was discussed above. In columns 1 and 2 we find negative impacts for competition and union recognition although these are not very significant. This is not very surprising given previous empirical evidence for the UK in Blanchflower and Burgess (1996). The impact of these two variables on absolute employment change is also negative, reflecting the prediction from section 2 that both job creation and job destruction will fall as the bargaining strength of firms is

---

[14]An alternative explanation for the impact of competition is provided in Davis and Haltiwanger (1992 and 1994) where it is argued that plants may acquire information about their efficiency level in a passive manner over a lengthy period of production. Plants that accumulate favourable information prosper and grow, plants acquiring unfavourable information may merely exist at their current size or exit. Gross job turnover can be seen as a means of adjusting to this information as the plant acquires it. A variant on this theme involves plants actively seeking information and attempting to affect their survival likelihood by engaging in investment. A firm who chooses wisely *ex poste* compared to its competitors will survive. Incorrect choices will lead to exit. The degree of competition faced by the firm will therefore have a negative relationship with gross job turnover. A third group of theories concentrates on the role that shocks can play resulting in substantial changes in the production process and perhaps the skill requirement of the workforce. Less exposed firms will have less reallocation, factors that can cushion a firm include limited competition and greater information of its efficiency levels.

reduced. The impact on average tenure is positive and significant in the case of product market competition, also in line with the prediction of our model. Increased bargaining strength of unions increases average tenure.

We examine whether the introduction of new technology *per se* has the effect of increasing the rate of employment change. (The variable *new tech* is a binary variable coded 1 if new technology has been introduced and 0 otherwise.) The evidence from our results is that the introduction of new technology raises absolute employment change and, consistently, reduces average job tenure, the latter being a more significant effect.

Our empirical model also includes a number of additional control variables. They are industry dummies (for the 2 digit industry definition), *labour intensity* (a discrete 6 valued variable measuring labour costs as a percentage of total costs), workplace *size* (a discrete 6 valued variable measuring number of employees in September 1998), *skill* requirements (a 3 valued discrete variable coded 1 if skill requirements have increased, -1 if decreased, and 0 if not changed), and *inexperience* (a discrete 5 valued variable measuring the proportion of the workforce who are under 20 years of age).

Our measure of labour intensity is an inverse measure of capital intensity. Previous studies have found that industries with high levels of capital intensity are associated with lower levels of job reallocation (Contini and Revelli, 1992). Our results for absolute employment change are consistent with these observations. We find labour intensity reduces net employment change thereby increasing average tenure. The standard results in the literature are that workplace size is associated with lower levels of job reallocation. Our results are in accordance with these findings and significantly so. We find a negative relationship between workplace size and both net and absolute employment growth. Average tenure is increased by the reduction in the creation flow and the increase in the obsolescence age that the employment growth results suggest. The skill measure is found to have a positive impact on employment growth as we would expect from the theory discussed above and is in accordance with findings from other studies (Davis and Haltiwanger, 1994). Finally, we find that a more inexperienced workforce is associated with less net employment growth but more absolute employment change. The second of the two results is in line with the observations of Davis and Haltiwanger (1994) and others. Both skill change and a more inexperienced workforce reduce average tenure according to the results in columns 5 and

6. In the first case, this is consistent with increased creation flow and in the second with reduced obsolescence age. These are the dominant influences of the employment change results.

The estimation results we present can be judged on two levels. First, they provide a more comprehensive multivariate analysis of three aspects of employment dynamics: net and gross employment change and average job tenure. Second, more importantly, they provide an empirical implementation of the extended model discussed in section 2. The model provides predictions for the determinants of all three aspects of employment dynamics. The almost complete consistency of these predictions with the three sets of empirical results provides a good degree of support for the key predictions of the model. The estimation results also provide a means of assessing the importance of specific features of the model such as the determination of job creation costs. The asymmetric impact of demand changes on net employment confirms that creation costs are a function of the job creation rate. The impact of demand shocks on average tenure confirms, in addition, that much adjustment takes place on the creation flow margin providing a positive lower bound between creation costs and the job creation rate.

V. Conclusions

This paper is concerned with the determinants of job reallocation and average job tenure. Analysis of a single panel of workplace data (AWIRS) demonstrates that simultaneous job creation and destruction is an important feature of the Australian labour market. We present measures of job reallocation across industries in Australia and provide comparisons of these flows with those calculated for studies from other countries. We find that in a year of strong employment growth across the country (some 5%), 5% of jobs were destroyed and 10% created. These results suggest that the gross job flow rate in Australia is higher than that experienced in the UK but lower than that in North America. The majority of this job reallocation was found to be taking place in workplaces that are experiencing moderate growth rates, in accordance to the findings of other international studies. If job reallocation is considered as a proportion of total worker reallocation, we can argue that some 46% of the worker reallocation in Australia between September 1988 and September 1989 was associated with workplace job reallocation.

In this paper, we extend two major strands in the literature: the theoretical work on job creation and destruction; and the evidence on three aspects of employment dynamics (net and gross employment changes and average job tenure) by implementing an extended version of the

Caballero and Hammour (1994) model on workplace data. We present results which provide clear evidence as to the nature of workplaces in which job reallocation is concentrated. Our regression results support the major prediction of the model: we find that employment growth is asymmetrically related to expected changes in demand for the output of the workplace; falls in demand have a negative impact which is substantially larger than the positive impact of increases in demand on employment growth. We also find that the absolute change in employment is lower for workplaces that are larger, older, more capital intensive or operating in a less competitive environment. Changes in skill requirements and relative wages are found to have a positive effect on job reallocation. We found the impacts on average tenure (except in the case of relative wages) are as expected from the model and from these changes in employment. Whilst some of the individual coefficients are only modestly significant, overall there is a substantial degree of agreement between the predictions of the model and our empirical results. Indeed, given our concentration solely on the firms demand for employees, the success of our empirical explanation for average job tenure is surprising. We know that changes in the firms demands for employees captures less than half of the total worker flows for Australia, we might expect to only be able to explain tenure to a similar degree as our other measures of employment dynamics. Our finding of a positive relationship between tenure and relative wages clearly suggests that the individual labour supply decisions of employees also need to be addressed within this framework.

There is a limit to the amount of heterogeneity in workplace job reallocation which partial equilibrium can be expected to explain. There is a another avenue for future studies to improve upon this work by further considering the causes of this heterogeneity. In particular, there is much scope to consider workforce heterogeneity and, for example, the possibility of self selection by low productivity employees for high turnover workplaces.

Bibliography

Aghion, P. and Howitt, P. (1994). 'Growth and Unemployment.' Review of Economic Studies 61; 477-494.

Anderson, P. A. and Meyer, B. B. (1994). 'The Extent and Consequences of Job Turnover.' In Baily, N.B., Reiss, P.C. and Winston, C. (Editors) Brookings Papers in Economic Activity: Microeconomics 1994 . Brookings Institution, Washington, D.C.

Blanchflower, D. G. and Burgess, S. M. (1996). 'Job Creation and Job Destruction in Great Britain in the 1980s.' Industrial and Labor Relations Review 50(1); 17-38.

Borland, J. (1996). 'Job Creation and Job Destruction in Manufacturing Industry in Australia.' The Economic Record 72; 46-63.

Broersma, L. (1996). 'Job Searchers, Job Matches and the Elasticity of Matching.' ALERT Research Memorandum 1994-4, Department of Economics, Free University Amsterdam, February.

Burda, M. and Wyplosz, C. (1994). 'Gross Worker and Job Flows in Europe.' European Economic Review 38; 1287-1315.

Caballero, R.J. and Hammour, M.L. (1994). 'The Cleansing Effect of Recessions.' American Economic Review 84(5); 1075-1084.

Caballero, R.J. and Hammour, M.L. (1996). 'On the Timing and Efficiency of Creative Destruction.' Quarterly Journal of Economics 111(3); 805-852.

CEPR. Centre for Economic Policy Research. (1995). Unemployment: Choices for Europe. Monitoring European Integration 5.

Contini, B. and Revelli, R. (1992). 'Gross Flows versus Net Flows: What is There to be Learned.' Paper presented to the ICER Workshop In Labor Market Dynamics, Torino 4-5 September, 1992.

Davis, S. and Haltiwanger, J. (1990). 'Gross Jobs Creation and Destruction: Microeconomic Evidence and Macroeconomic Implications.' NBER Macroeconomics Annual, Chicago.

Davis, S. and Haltiwanger, J. (1992).'Gross Job Creation, Gross Job Destruction and Employment Reallocation.' Quarterly Journal of Economics 107(3); 819-863.

Davis, S. and Haltiwanger, J. (1994). 'Driving Forces and Employment Fluctuations: New Evidence and Alternative Interpretations.' Mimeo, University of Maryland.

Davis, S. and Haltiwanger, J. (1995). 'Measuring Gross Worker and Job Flows.' NBER Working Paper No. 5133 May.

Davis, S. Haltiwanger, J. and Schuh, S. (1996). Job Creation and Job Destruction. MIT Press: Cambridge, USA.

Killingsworth, M. (1983). Labor Supply. Cambridge University Press: Cambridge, USA.

Konings, J. and Pissarides, C. A. (1994). 'The Creation, Retention and Destruction of Jobs.' Paper presented at the Centre for Economic Performance Annual Conference, May.

Konings, J. (1995). 'Job Creation and Job Destruction in the U.K. Manufacturing Sector.' Oxford Bulletin of Economics and Statistics 57; 5-24.

Mortensen, D. T. (1986). 'Job Search and Labor Market Analysis.' in Ashenfelter, A. and Layard, R. (eds) Handbook of Labor Economics Vol II. Elsevier Science Publishers: Amsterdam, Holland.

Mortensen, D. T. and Pissarides, C. A. (1995). 'Technological Progress, Job Creation and Job Destruction.' Centre for Economic Performance Discussion Paper 264, September.

Mumford, K. and Dowrick, S. (1994). 'Wage Bargaining with Endogenous Profits, Overtime Working and Heterogenous Labor.' *Review of Economics and Statistics*, 76(2); 329-336.

OECD. (1994). Employment Outlook. Paris.

Table 1. Gross job flows, 1988-89.

	no adjustment				with max adjustment				ABS
industry	pos	neg	gross	net	pos	neg	gross	net	net
mining	12.1	-1.9	14.0	10.2	13.6	-1.9	15.5	11.7	10.1
manufact	6.3	-5.1	11.4	1.2	7.9	-5.0	13.0	2.9	2.7
elec, gas & water	2.3	-5.3	7.6	-2.9	2.3	-5.3	7.6	-2.9	-0.4
construct	9.3	-6.6	15.7	2.7	11.5	-6.4	17.9	5.2	12.7
wholesale & retail trade	7.1	-7.8	14.9	-0.7	11.3	-7.6	18.9	3.7	6.7
transport & storage	12.0	-3.9	15.9	8.1	14.0	-3.9	17.9	10.2	7.2
communic	4.4	-2.4	6.8	2.0	6.7	-2.4	9.1	4.3	3.6
finance & business	7.8	-5.9	13.7	1.8	12.7	-5.8	18.5	6.9	8.3
public admin	3.7	-4.4	8.1	-0.7	7.7	-4.3	12.0	3.4	0.4
community service	4.7	-2.9	7.5	1.8	11.1	-2.8	13.9	8.4	3.6
rec & pers services	6.5	-12.0	18.5	-5.5	12.2	-11.6	23.8	0.5	4.5
total	6.3	-5.2	11.5	1.1	10.1	-5.1	15.2	5.0	5.6

Table 2. Employment dynamics, 1988-89.

log employment change	net		absolute		log ave tenure	
	(1)	(2)	(3)	(4)	(5)	(6)
constant	0.09	0.04	0.07	0.08	1.61	1.71
	(1.59)	(0.61)	(1.51)	(1.53)	(11.54)**	(12.41)**
demand up	0.039	0.040	-0.01	-0.01	-0.06	-0.04
	(2.07)**	(2.09)**	(0.73)	(0.71)	(1.44)	(1.09)
demand down	-0.055	-0.063	0.01	0.002	0.04	0.05
	(1.98)**	(2.25)**	(0.49)	(0.10)	(0.71)	(0.88)
age	-0.001		-0.001		0.005	
	(1.50)		(1.36)		(5.06)**	
age <2		0.24		0.13		-0.0003
		(1.99)**		(1.15)		(0.002)
age 2-5		0.03		-0.04		-0.26
		(0.08)		(1.58)		(3.13)**
age 5-10		0.07		0.01		-0.16
		(2.40)**		(0.51)		(2.71)**
age 20-50		0.02		-0.03		0.11
		(1.05)		(1.75)*		(2.38)**
age >50		0.01		-0.01		0.18
		(0.56)		(0.50)		(3.34)**
new train	0.04	0.04	-0.01	-0.01	0.05	0.05
	(2.28)**	(2.30)**	(0.44)	(0.43)	(1.29)	(1.43)
rel wage	0.02	0.02	0.02	0.02	0.04	0.05
	(1.87)*	(2.06)**	(1.88)*	(2.11)**	(1.98)**	(2.09)**
union recognition	-0.03	-0.03	-0.02	-0.03	0.02	0.003
	(0.94)	(0.97)	(0.75)	(0.88)	(0.39)	(0.06)
competition	-0.01	-0.01	-0.01	-0.01	0.08	0.07
	(0.43)	(0.38)	(0.44)	(0.35)	(2.21)**	(2.02)**
tech introd.	-0.003	0.002	0.02	0.02	-0.06	-0.07
	(0.19)	(0.09)	(1.13)	(1.22)	(1.66)*	(1.92)*
labour intensity	-0.01	-0.04	0.10	0.08	0.06	0.07
	(0.23)	(1.02)	(2.35)**	(2.09)**	(0.68)	(0.69)
size	-0.02	-0.02	-0.01	-0.01	0.05	0.05
	(3.12)**	(2.95)**	(1.24)	(0.96)	(3.39)**	(3.51)**
skill	0.03	0.03	0.004	0.003	-0.03	-0.03
	(2.03)**	(1.90)*	(0.36)	(0.23)	(0.91)	(0.91)
inexperience	-0.28	-0.26	0.09	0.10	-0.39	-0.41
	(4.10)**	(3.93)**	(1.73)*	(1.79)*	(4.16)**	(4.46)**
Adj R^2	0.1001	0.1238	0.0530	0.0679	0.3607	0.3712
No. obs	613	615	613	615	604	605

Estimation method: GLS. Industry dummies included. Heteroscedasticity robust absolute t-values in parentheses. ** denotes significance at the 95% level; * 90% level.

Figure 1. Workplace growth rates.

Table 2old. Employment dynamics, 1988-89.

employment change (%)	net		absolute		ave tenure
	(1)	(2)	(3)	(4)	(5)
constant	9.88	10.11	10.66	11.65	6.19
	(2.06)**	(0.20)**	(0.20)**	(0.19)**	(0.02)**
demand up	4.41	4.46	0.04	0.58	-0.28
	(0.07)**	(0.07)**	(0.06)**	(0.06)**	(0.005)**
demand down	-5.02	-4.96	-0.09	-0.18	0.23
	(0.07)**	(0.07)**	(0.06)	(0.06)**	(0.008)**
tech introd.	0.41		1.90		-0.35
	(0.06)**		(0.05)**		(0.005)**
age	-0.12	-0.12	-0.13	-0.12	0.03
	(0.002)**	(0.002)**	(0.002)**	(0.002)**	(0.0001)**
new train	5.53	5.53	1.47	1.47	0.31
	(0.07)**	(0.07)**	(0.07)**	(0.07)**	(0.005)**
rel wage	1.92	1.94	1.68	1.79	0.21
	(0.03)**	(0.03)**	(0.03)**	(0.03)**	(0.003)**
union recognition	-10.28	-10.31	-8.63	-8.78	0.23
	(0.21)**	(0.21)**	(0.21)**	(0.20)**	(0.007)**
competition	-0.80	-0.81	-0.79	-0.89	0.45
	(0.05)**	(0.05)**	(0.04)**	(0.04)**	(0.005)**
labour intensity	7.15	7.10	15.88	15.63	0.42
	(0.23)**	(0.23)**	(0.22)**	(0.22)**	(0.01)**
size/100	-0.67	-0.66	-0.16	-0.11	0.08
	(0.004)**	(0.004)**	(0.004)**	(0.003)**	(0.0006)**
skill	3.47	3.50	1.20	1.33	-0.29
	(0.05)**	(0.05)**	(0.05)**	(0.05)**	(0.004)**
inexperience	-29.49	-29.51	6.26	5.45	-0.181
	(0.17)**	(0.17)**	(0.15)**	(0.15)**	(0.01)**
Adj R^2	0.054	0.056	0.03	0.03	0.31
No. obs	613	613	613	613	604

Estimation method: GLS. Industry dummies included. Heteroscedasticity robust standard errors in parentheses. ** denotes significance at the 95% level; * 90% level.