Why are Establishments so Heterogeneous?

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ABSTRACT. Changes in the size of establishments – as opposed to the turnover of workers across a given set of jobs – account for a non-negligible component of gross workers flows. Based on a rich database of establishment-level employment records in western Germany, this paper analyses the magnitude and determinants of job turnover and its relation with labour turnover. Consistently with findings from other countries, it is shown that job turnover is mainly the byproduct of the dispersion of establishment-level outcomes within any industry rather than of job reallocation across different sectors. The role played by disturbances to consumer preferences over differentiated products is also assessed in an attempt to shed some light on the determinants of this tremendous heterogeneity of establishment-level employment changes within each industry.

Introduction

Each year the growth, decline, entry and exit of establishments results in large number of workers changing jobs or switching from employment to non-employment. A salient feature of these establishment-level employment changes is churning, that is, the simultaneous creation and destruction of thousands of jobs. Abstracting from cyclical movements, high rates of gross job creation coexist with high rates of gross job destruction.

The impressive magnitude of gross job turnover has been vividly documented by recent empirical work based on longitudinal data sets of establishments and firms. In all countries for which data are available the sum of gross job creation and destruction accounts for about 20 per cent of total employment, that is, each year about one in five jobs changes. Changes in the size of establishments – rather than the turnover of workers across a given set of jobs – seem therefore to account for a non-negligible component of gross worker flows. Put another way, labour demand factors appear to explain much of the labour turnover.

While several models have been developed which can account for high labour turnover rates, many questions raised by the magnitude and characteristics of job reallocation rates are still looking for satisfactory answers. What lies behind the heterogeneity of establishment-level outcomes? Does it reflect differential sectoral responses to cyclical fluctuations, asymmetric reactions of firms within any sector to industry-wide disturbances or firm-specific shocks? Which role does product differentiation play in job turnover?

The purpose of this paper is twofold. First, it aims at characterising the heterogeneity of establishment-level employment changes and its relation with labour turnover. Second, an assessment is made of the role played by product heterogeneity in the coexistence of high entry, exit, contraction and expansion rates within any industry.

The central empirical findings are as follows:

1) gross worker flows associated with changes in the size of establishments – rather than to the sorting and resorting of jobs across a given set of jobs – account for a significant component of labour turnover;
2) job turnover is mainly the byproduct of the dispersion of establishment-level employment changes within any industry rather than of job reallocation across different sectors;
3) product differentiation tends to increase the dispersion of establishment-level outcomes within any industry, provided that the technological differences across the various products are not too large.

We will first analyse the magnitude of job turnover in relation with aggregate employment growth and labour turnover. The focus will be then on the role played by industry effects in job turnover. Finally, we will investigate the relation

Final version received on January 17, 1994

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Small Business Economics **6**: 409–420, 1994.

between product differentiation and the dispersion of growth rates within any industry based on the empirical implications of a model where the heterogeneity of firms is the byproduct of endogenous product choices.

1. Definitions

Let x_{it} denote the number of employees of any establishment i at time t. Then total gross job flows associated with establishment-level employment changes (or job turnover) is given by:

$$JT_t(E) \equiv \frac{\sum_{i \in E} |x_{it+1} - x_{it}|}{\sum_{i \in E} x_{it}}$$

where E denotes any aggregate (e.g., a sector, a region or a group of plants belonging to the same size cell in the base year) of establishments. Job turnover can be interpreted as a summary measure of the heterogeneity of establishment-level employment changes. In fact, let s_{it} be the employment share of any individual establishment i at t and g_{it} be its (employment) growth rate between t and $t + 1$. Then for all establishments having some positive employment at t, job turnover can also be rewritten as:

$$JT_t(E) = \sum_{i \in E} |g_{it}| s_{it}$$

$$\text{where } E = \{x_t \in E / x_t > 0\}.$$

that is, JT is a weighted (by the respective employment share) sum of deviations of establishment-level growth rates from zero.

Job turnover, unlike other measures of the heterogeneity of establishment-level outcomes – e.g., the standard deviation of establishment growth rates – has a close connection with economic concepts such as job creation and destruction, and labour turnover. In particular, following OECD (1987), and Davis and Haltiwanger (1990), we decompose JT by considering, on the one hand, only expanding and entering units, and, on the other hand, contracting and exiting units. In particular, gross job creation (POS) is defined as follows:

$$POS_t(E) \equiv \frac{\sum_{i \in E^+} (x_{it+1} - x_{it})}{\sum_{i \in E} x_{it}}$$

$$\text{where } E^+ = \{x_t \in E / x_{t+1} > 0 \text{ and } x_{t+1} > x_t\},$$

whereas gross job destruction (NEG), induced by shrinking units *and* exit processes, is given by:

$$NEG_t(E) \equiv \frac{\sum_{i \in E^-} |x_{it+1} - x_{it}|}{\sum_{i \in E^-} x_{it}}$$

$$\text{where } E^- = \{x_t \in E / x_t > 0 \text{ and } x_t > x_{t+1}\}.$$

We can then rewrite job turnover as follows:

$$JT_t \equiv POS_t + NEG_t$$

Finally, by subtracting *NEG* from *POS* one obtains net job creation or the employment growth rate (*NET*).

2. Job turnover, aggregate employment growth and labour turnover

Evidence on job turnover in all countries for which data are available is presented in Table I. As data come from a variety of sources (mainly from establishment surveys and administrative records, e.g., social security files), and provide a different coverage of total employment (e.g., in the US they cover only manufacturing employment, while in Germany all private employees), figures are not strictly comparable.[1] Yet, they offer a broad indication of the order of magnitude of job turnover.

From Table I it would appear that job turnover ranges between 15 and 25 per cent, that is, each year about one in five jobs is created or destroyed. Moreover, job turnover is much larger than changes in aggregate employment (reported in the second column of the table). Job turnover in excess of net employment growth (third column) is no less than 14 per cent in all countries for which data are available. In other words, a salient feature of job turnover is the churn, the simultaneous creation and destruction of thousands of jobs.

Insofar as job turnover reflects changes in the allocation of employment opportunities across establishments, it also involves a reallocation of

TABLE I
Gross and net job flows (as % of employment in the base year, average of yearly data)

Country	Years	JT	NET	JT-|NET|
Canada	(1984–90)	22.6	4.4	18.2
Denmark	(1984–89)	29.8	2.3	27.5
Finland	(1988–91)	24.2	–3.6	20.6
France	(1985–87)	26.3	0.1	26.2
Germany	(1977–89)	15.9	0.9	15.0
Italy	(1985–91)	23.4	1.8	21.6
Norway	(1976–86)	15.6	0.7	14.9
Sweden	(1985–91)	22.7	1.2	21.6
UK	(1982–91)	15.2	1.0	14.2
USA	(1976–91)	21.5	1.7	19.8

Source:
Canada: Statistics Canada: Small Business and Special Surveys.
Denmark: Danmarks Statistiks.
Finland: Business Register of the Finnish Statistical Office.
France: UNEDIC (Union Nationale pour l'Emploi dans l'Industrie et le Commerce).
Germany: Federal Office of Labour (Bundesanstalt fur Arbeit).
Italy: National Social Security Institute (INPS).
Norway: Statistik Sentralbyra, Central Register of Establishment and Enterprises.
Sweden: Business register of the Department of Business Statistics of the Statistical Office.
UK: Dun and Bradsheet credit reference files.
US: Small Business Data Base (USEEM and USELM).
See the Annex for details on the data sources.

workers across establishments. The extent of labour turnover originated by establishment-level employment changes is difficult to assess insofar as workers involved by the contraction of a plant may well move directly to another unit expanding its workforce, in which case the *JT* statistics would double-count the actual gross flow of workers. Yet, data on gross job flows can provide an upper and a lower bound for the component of labour turnover which is directly associated to changes in the size of establishments. It should be stressed that labour turnover related to changes in the size of establishments is itself a lower bound for total labour turnover.

As suggested by Davis and Haltiwanger (1990), the upper bound for this component of labour turnover, $\overline{LT}$ is simply given by the total sum of gross changes in the size of establishments, that is:

$$\overline{LT}_t = POS_t + NEG_t$$

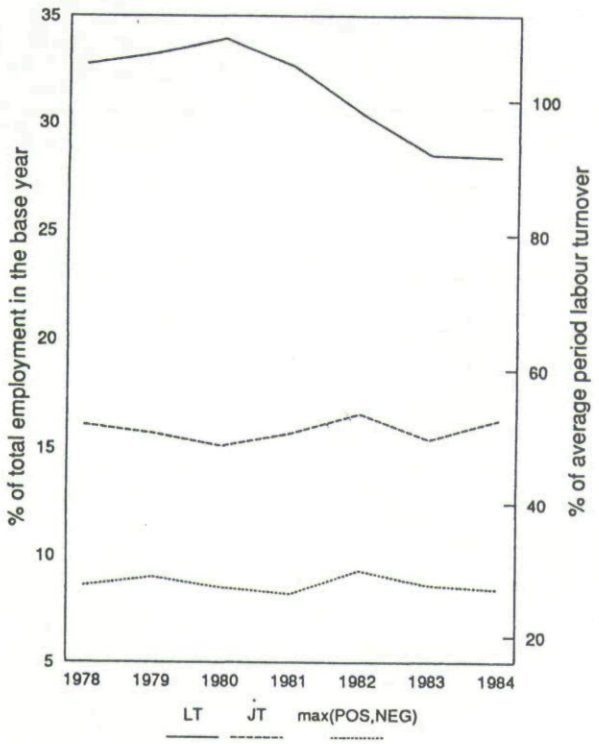
and the lower bound by:

$$\underline{LT} = \max\{POS_t, NEG_t\}$$

which clearly avoids the double-counting of direct flows of workers from declining to expanding units.

Unfortunately, labour turnover data come often from different statistical sources than data on gross job flows, which makes it more difficult to assess the role played by job turnover in gross worker flows. In the case of western Germany, however, a representative sample from the social security register on which job turnover statistics are based[2] has been used in previous studies (Cramer and Koller, 1988) to construct series of labour turnover partly overlapping with our job turnover data. Hence, it is possible to compare series of total labour turnover with our upper and lower bound measures.

Figure 1 suggests that between 25 and 55 per cent of total labour turnover is accounted for each year by changes in the size of establishments. Put another way, at least one fourth of total gross worker flows originates from plant expansions, contractions or by the startup and close-down of business units.[3] Understanding the sources of the heterogeneity of establishment-level employment changes means therefore understanding one of the main sources of labour turnover. In the following



Source: BA, Cramer and Koller (1988).
The correlation coefficient between *JT* an *LT* is –0.39 (0.38); between *LT* and max(POS, NEG) is –0.02 (0.97).

Fig. 1. Job turnover and labour turnover (as per cent of employment in the base year) Germany, 1978–84.

section we will try to identify the main components of job turnover by making use of detailed information available on gross job flows in western Germany.

3. Within industry and between industry heterogeneity

Table II quantifies the different components of job turnover. In the top panel, information is provided on the fraction of job turnover which is accounted for by different sectors and by establishment of different size. This shows that job turnover is particularly high in service sectors and in small plants: more than 50 per cent of total gross job flows take place in service sectors and in small establishments. These two groups of establishments account therefore for much larger a fraction of job turnover (second column) than implied by their share in total employment (first column).

Are such marked differences in the distribution of job turnover between manufacturing and service sectors associated with a different employment performance of the two sectors? Is, more generally, job turnover related to inter-industry job reallocation? The bottom panel of Table II disentangles[4] *between-industry* from *within-industry* job turnover in excess of aggregate employment growth. In particular, we apply the following

TABLE II
Decomposition of gross job flows (Germany 1977–90, average of yearly observations).

Services, manufacturing, small and large establishments			
	% of employment	% of gross job flows	JT
Manufacturing	43.4	35.1	12.3
Services	42.0	52.0	18.9
Small establishments[a]	25.5	56.4	33.7
Large establishments[b]	28.1	11.6	6.3
Between and within sectors			
	# of jobs (000)	% of gross job flows	JT
Between sectors[c]	165	5.7	0.8
Within sectors[c]	2488	85.9	13.3

Notes: [a] Establishments with less than 20 employees.
[b] Establishments with more than 500 employess.
[c] 81 sectors (3-digits sectoral breakdown).

decom-position of job turnover in excess of net employment growth:

$$E(JT - |NET|) = (\Sigma_j |NET_j| E_j - |NET| E) + (\Sigma_j JT_j E_j - |NET_j| E_j) = JT^{BETWEEN} + JT^{WITHIN}$$

where the subscript j denotes 81 different sectors, corresponding to a three-digit sectoral breakdown and E_j denotes employment in industry j. When all job reallocation occurs *within* industries, then the sum of sectoral employment changes equals aggregate employment growth, and hence $JT^{BETWEEN}$ is zero. Similarly, when all job reallocation occurs *across* industries, then job turnover is equal to net employment growth (in absolute value) in each industry, and hence JT^{WITHIN} is zero.

As shown in the table, job reallocation *within* sectors involves each year about 2.5 million workers, that is about 13 per cent of total employment in the BA register and 86 per cent of total job turnover. Shifts of jobs and workers across industries account instead for only about 6 per cent of job turnover and less than 1 per cent of total employment. It should be stressed that these results refer to a rather detailed sectoral breakdown (3-digit SITC). Hence, they do not seem to be attributable to a limited control for inter-industry differences.[5]

Thus, job creation is large even in declining industries and job destruction is significant even in expanding sectors. This wide dispersion of establishment-level employment changes within each industry may simply reflect normal rates of worker attrition. However, there is evidence that most changes in the size of establishments are discrete, involving growth rates in excess of 50 per cent, rather than marginal adjustments of the work-force. Table III displays the distribution of establishments and gross job flows according to the magnitude of establishment-level growth rates. This shows that about one out of four declining or expanding units is experiencing growth rates in excess of 50 per cent and that about 25 per cent of total gross job flows is accounted for by these fast expanding or declining plants. It should be stressed that such discrete growth rates are experienced also by the largest units in the sample, which means that employment *variations* are discrete.[6]

The high dispersion of establishment growth rates within each sector may also reflect temporary layoff or recall policies of firms, in which case intra-industry heterogeneity would not be associated with lasting changes in the allocation of employment opportunities. But neither gross job creation nor gross job destruction would appear to be temporary phenomena. Rather, the size of establishments is remarkably stable (Leonard, 1988; Boeri, 1990), and jobs created and destroyed by establishments display a remarkable degree of persistence (Davis and Haltiwanger, 1992; Violante and Prat, 1992), which means that worker reallocation associated with job turnover cannot be temporary.

Summing up, there is a tremendous heterogeneity of establishment-level outcomes within any industry. This heterogeneity matters from a macroeconomic standpoint because it involves large scale flows of workers across business units, and does not merely reflect either temporary layoff and recall policies, nor normal rates of worker attrition.

4. Theories of plants' heterogeneity

Once it is established that intra-industry heterogeneity of establishment-level employment

TABLE III
Distribution of establishments by their employment performance (Germany 1978)

	# of establishments	% of total # of establishments	% of job turnover
Stable	502476	44.8	
Declining	266177	23.7	36.5
of which rapidly[a]	64547	5.8	12.6
Expanding	353335	31.5	39.0
of which rapidly[a]	100310	8.9	13.2

Notes: [a] Establishments with growth rates (in modules) in excess of 50%.

changes matters, the issue is finding adequate explanations for the coexistence of so many episodes of success and failure within each sector. Unfortunately, most of the theoretical literature focuses on workers'[7] – as opposed to establishments' or firms' – heterogeneity and models that can mimic the wide dispersion of establishment-level employment changes are either lacking or often not capable of explaining the ultimate sources of plant-level heterogeneity.

A simple way to model the heterogeneity of establishment-level outcomes in an industry is to hit firms with a sequence of exogeneous, idiosyncratic shocks (Hopenhayn, 1992; Davis and Haltiwanger, 1992). Lucky firms expand; unlucky units shrink. The source of these disturbances is immaterial: they can come either from the input side or from the demand side; what matters is that idiosyncratic shocks lead to simultaneous creation and destruction of jobs within the same industry. However, all this leaves the ultimate sources of heterogeneity unexplained. Why should shocks depend on the specific conditions of each firm rather than of the industry they belong to?

Another approach, which seems to us to be more promising in terms of its heuristic content is try to isolate those factors that create systematic differences in the way in which enterprises react to the same set of disturbances. There is a variety of models that can accommodate a large intra-industry heterogeneity in response to aggregate or industry-wide shocks. For instance, Bayesian learning models of the firm (Jovanovic, 1982; Ericson and Pakes, 1990) can generate asymmetric reactions of firms to common shocks, depending on their knowledge of their underlying efficiency, and hence ultimately on their age. Similarly, vintage models of technological change where new firms displace incumbents by introducing more efficient techniques embedded in new machinery, can generate a dispersion of establishment-level outcomes within any industry (Jovanovic and Lach, 1989). The coexistence of job creation and job destruction has to do in these models with asymmetries in cost structures of firms operating in the same industry, but what ultimately matters is also in this case the age of firms.

Empirical evidence on the employment performance of different cohorts of establishments (Boeri and Cramer, 1992) points, however, to a wide dispersion of growth rates within each cohort and tough selection processes after the startup of plants.[8] This may suggests that other factors, besides age, are likely to play a major role in plant-level heterogeneity.

Surprisingly enough, little attention has been so far devoted to product differentiation as a source of plant-level heterogeneity. Models where firms in an industry differ by their (endogenous) product choice would, however, generate heterogeneous responses of firms to industry-wide disturbances. They could also provide useful insights and possibly have testable implications on the relation between plants' heterogeneity and observables such as common measures of product diversification. In the following section we will develop a model that has these properties and highlight its empirical implications on job turnover.

5. A simple model of establishments' and workers' heterogeneity

Let $z \in Z$ denote the type of products in an industry and suppose, for simplicity that there are only three possible kinds of products, i.e., that $Z = \{-1, 0, 1\}$. Following Boeri (1992), the location on Z can be thought of as reflecting a trade-off between two different characteristics. In other words, products can be either specialised, i.e., focussed on one of the two characteristics or homogenised ($z = 0$), that is, embodying both characteristics in the same degree.

By imposing rather mild restrictions on consumers' preferences and assuming that all consumers are perfectly informed about prices and characteristics of all products available in the market, the following arbitrage condition can be derived:[9]

$$p(z) = p + \sigma z$$

where p stands for the price of the homogenized good, since $p(0) = p$, and σ for the degree of *specialization* of preferences, i.e., the extent by which consumers rank specialised over homogenised goods. Suppose further that σ is random[10] and can take only two values, namely $\hat{\sigma}$ and $-\hat{\sigma}$ depending on whether (+) or (–) is the quality attribute most preferred by households. In particular, we assume that σ evolves as a symmetric first-order Markov process, and denote by π the

"stayer coefficients" of this process, that is, the probability that σ tomorrow is equal to its current realization. In order to obtain a non-degenerate distribution of firms over Z we further impose that $\pi > 1/2$. There must be a certain degree of persistence in consumers preferences. Otherwise all firms would locate at $z = 0$.

Each firm employs a worker. Firms can change the design of products, but this involves some relocation costs, d, that we will assume to be proportional to the distance between the different product types. A possible way to rationalise such costs is in search or re-training costs[11] associated to the development of new product types. Current returns are then simply given by:

$$r(z, z', p, \sigma) = (p + \sigma z)q - c(q) - d(z' - z)$$

where $c(q)$ denote a well-behaved cost function, q is output and z' is next period location

The sequence of decisions of any firm is as follows: at t the state of the economy, i.e., the couple $[\sigma, p]$ is observed.[12] This allows firms to infer the price for any produceable variety. The firm then sets current output, and next period location, i.e., a one period time lag is required in order to develop any new product. A one-period lag is required also to enter or withdraw from the industry and entry and exit decisions are not reversible.

The (discounted) value of a firm producing good z is therefore given by:

$$V(z, p, \sigma) = \max_{z'} r(z'; z, p, \sigma) + \beta \max\{0, \pi V(z', p', \sigma) + (1 - \pi)V(z', p', -\sigma)\}$$

where 0 represents the option of exit (exit is made before observing σ') and the second term within brackets the expected value of remaining in the industry and choosing optimally the new product. When π is sufficiently large, that is, shocks are highly persistent, the value function will be increasing in z when $\sigma = \hat{\sigma}$ and decreasing in z when $\sigma = -\hat{\sigma}$.

Entrants must face some positioning (e.g., training) costs that – by symmetry with relocation costs – we assume to equal d. The entry equilibrium condition is therefore given by:

$$\begin{aligned} \beta E[V(z^e, p', \sigma')] - d = 0 \quad & \text{if } n^e(z^e) > 0 \\ \leq 0 \quad & \text{if } n^e(z^e) = 0 \end{aligned}$$

where z^e denotes location at entry and $n^e(z^e)$ the number of entrants at z.

As shown below, the system converges to two equilibrium distribution of firms, depending on the value of σ. Let $\mu^+ = (n^+_{-1}, n^+_0, n^+_1)$, where n^+_j is the mass of firms located at j, be the equilibrium distribution to which the industry converges when $\sigma = \hat{\sigma}$ and $\mu^- = (n^-_{-1}, n^-_0, n^-_1)$ be the equilibrium distribution when $\sigma = -\hat{\sigma}$. By symmetry around zero of this setup, we have that $n^+_1 = n^-_{-1}$, $n^+_0 = n^-_0$, n^+_{-1}, $= n^+_1$ and hence $n^+ = n^-$, where n denotes the total number of firms in the industry.

As each firm employs only one worker, job turnover is given in this model simply by the sum of entering and exiting units over the initial population of firms, i.e.:

$$JT = \frac{n^e + n^d}{n}$$

Assume that at t, the distribution is $\mu_t = \mu^+$ and $\sigma_t = \hat{\sigma}$. No entry nor exit occurs at t. Suppose now that in the following period $\sigma_{t+1} = -\hat{\sigma}$. At the end of the period entry and exit occur. By monotonicity of the value function, all exiting units will come from 1 and all entrants will go to –1. No relocation occurs. In fact, suppose that some firms located at 0 move to –1. Then it must be that:

$$p_{t+1} - d + \beta E[V(-1, p_{t+2}, \sigma_{t+2})] > p_{t+1} + \beta E[V(0, p_{t+2}, \sigma_{t+2})]$$

or

$$\beta E[V(-1, p_{t+2}, \sigma_{t+2})] > d + \beta E[V(0, p_{t+2}, \sigma_{t+2})]$$

which violates the entry equilibrium condition.[13] By the same token no firm relocates from 1 to 0 or from 1 to –1.

If the next period $\sigma_{t+2} = -\hat{\sigma}$, the distribution at this point will be $\mu_{t+2} = \mu^-$ and the story repeats from here on.

Job turnover is the byproduct in this model of zero-sum job creation and destruction occurring at the two ends of the quality spectrum. The magnitude of job turnover will depend on the value of d and σ. Large d will negatively affect entry, hence exit and job turnover, while large σ will make the value function steeper in z, thereby increasing the

magnitude of job turnover. Insofar as these two parameters vary across industries, they are a source of differences in the magnitude of job turnover across sectors.

6. Testing the empirical implications of the model

In order to test these empirical implications of the model we clearly need some measure of product diversification in various industries. Limited to two years (1979 and 1989), we had access to data on the 4-digit product specialisation of firms. This allowed to computing for each two-digit sector a standard, Herfindahl type, index of diversification,[14] namely:

$$P_j = \frac{1}{2}(1 - \Sigma_i s_i^2)$$

where s_i denotes the employment share of establishments producing good "i". As can be shown, P_j is increasing in the number of different products in an industry, and decreasing in the inequality of their distribution.[15] An advantage of this index – compared to common measures of the extent by which intra-industry job turnover decreases moving from, say, 2-digits to 3-digits sectoral breakdowns (Dunne, Roberts and Samuelson, 1989; Davis and Haltiwanger, 1992) – is that it does take into account the distribution of firms across different varieties. A disadvantage of this index is that the statistical classification of industries may not be uniform, due to delays in the recognition of new products and in the removal of the old ones (Streitweiser, 1991).

According to the model, the more specialised are consumers' preferences, the larger is job turnover. However, the model shows that when product types are much different one of another then large differences in the technology used to produce the different products may negatively affect job reallocation within any industry. The economics behind this result is that product-specific technologies and skills increase the costs of turnover for both employers and employees. The technological distance across different product-types can be tentatively controlled for by using an index of heterogeneity recently put forward by the literature (Gollop and Monahan, 1991):

$$C_j = \frac{1}{2}\left[\sum_i \sum_{k \neq i} s_i s_k \left(\sum_{k \neq i} \frac{|w_{kj} - w_{ij}|}{2}\right)^{1/2}\right]$$

where w_{kj} stands for the average share of inputs type "j" in total inputs for the establishments producing good "k". C_j is increasing in the differences in the input mix of establishments producing different goods, and hence provides a summary measure of the technological distance between different varieties, weighted by their employment share in the industry. We used data on the educational attainments of workers[16] to distinguish between different kind of workers and skills.

Table IV displays the results obtained by running the following regression against 2-digit manufacturing industry data in the two periods for which detailed data on products and on the input mix of various industries were available:

$$JT_j - |NET_j| = \alpha + \beta C_j + \gamma P_j$$

The dependent variable is gross job reallocation in excess of variations in employment of the various sectors, hence a summary measure of the heterogeneity of establishment-level employment changes in different industries.

Although the significance of the estimates is not fully satisfactory, the sign of the coefficients for C_j and P_j is in line with the predictions of the model. In particular, differences in the composition of labour inputs across firms producing different products appear to negatively affect job turnover, whereas a large number and uneven distribution of different product types seem to positively affect job re-allocation within each sector.

TABLE IV
Sources of heterogeneity of establishment-level outcomes (regression results)

Dependent variable: $JT_j - \|NET_j\|$	1979	1978
Intercept	0.038	0.044
	(4.36)	(4.60)
C_j	–0.280	–0.340
	(1.56)	(1.04)
P_j	0.070	0.137
	(1.09)	(1.26)
R^2	0.03	0.05

Notes: t-statistics (absolute values) based on adjusted White's heteroskedasticity consistent standard errors in parentheses; number of observations = 39.

Overall, regressions suggest that the more product-types in an industry and the less technologically dissimilar one of another, the larger is job turnover. Needless to say, further empirical work and possibly the access to a richer (at least 4-digits) breakdown of industries would be required to build-up adequate measures of product differentiation and technological distance across products. But our results already indicate that there is some scope for relaxing the standard product homogeneity assumption of most dynamic theories of the firm.

Summary and conclusions

Expansions and contractions of pre-existing units as well as entry and exit processes account each year for a large component of worker flows. Labour turnover generated by job turnover does not seem to reflect temporary layoffs or recall policies, but changes in the allocation of employment opportunities displaying a remarkable degree of persistence. All this points to the importance of understanding the sources of the simultaneous occurrence of job creation and destruction on a large scale.

Since job turnover has to be attributed mainly to the dispersion of establishment-level employment changes in an industry rather than to the variance of growth rates of various sectors, we focus on sources of plant-level heterogeneity *within* each sector. Based on a model of endogenous product choice, we show that the heterogeneity of products in an industry contributes to explaining simultaneous job creation and destruction, provided that products are not too dissimilar one of another. In fact, empirical evidence suggests that large differences in the input mix used in the production of the different products tend to reduce the mobility of workers and jobs across units in the same industry.

It follows that the heterogeneity of establishment-level outcomes is not merely an issue for statisticians. Rather, identifying the sources of job reallocation involves not only using more detailed sectoral breakdowns, but also defining economically meaningful measures of the distance between different varieties. After all, the proposed indexes of plant-level heterogeneity rely on measures of the difference in the input mix and of inequality of the distribution of employment across the different product types that have little to do with the work of statisticians and much to do with that of economists.

Appendix – data sources

Canada

Data come from the Small Business database maintained by Statistics Canada on the basis of tax forms filled annually by employers and providing information on the total wage bill of private enterprises (excluding the self-employed). Estimates of employment in each unit are obtained by dividing data on the wage bill in each enterprise by annual average earnings per employee of the same industry and province, the latter data drawn from Canada's monthly establishment survey. These employment estimates may therefore seriously underestimate the actual number of workers in all sectors where part-time employment is significant. By the same token, employment in closing units may be underestimated as their wage bill may refer only to part of the year.

Denmark

Data are collected by the Danish Statistical Office (Danmarks Statistiks) on the basis of various administrative sources (tax forms, unemployment register data and population registers). Identifiers are provided for both business units and workers. This makes it possible to distinguish establishments not only on the basis of their physical location or ownership, but also based on their workforce, which allows for a better identification of true "births" and "deaths". In particular, establishment identifiers would not change even when the plant has changed owner and location, but at least 30 per cent of the workforce is still employed.

Finland

Data are drawn from the Business Register maintained by the Finnish Statistical Office. Information on establishment-level employment stocks at yearly frequencies is deducted from tax forms filled in by employers and by annual surveys carried out by the statistical office. The

database does not cover the self-employed and the public administration. Identifiers are assigned to establishments on the basis of their location and branch of activity and change only if one of the two is modified. Hence, mere changes in ownership do not involve changes in establishment identifiers.

France

Data are drawn from the Unemployment Insurance records of the "Union pour l'Emploi dans l'Industrie et le Commerce" (UNEDIC) where all private employers with at least one dependent employee are compelled to register. Individual establishments (not firms!) are assigned identification numbers which makes it possible to follow plant-level employment histories over time. UNEDIC data seem to cover about 70 per cent of total dependent employment in France, the remaining 30% consisting of civil servants and self-employed. The coverage of UNEDIC data is particularly high in manufacturing and in traded services.

Germany

Data are drawn from the Employment Statistics register of the Federal Office of Labour (Bundesanstalt für Arbeit), and collected via the Social Insurance procedure introduced in 1973 that compels employers to report every year all changes occurred in the number of workers who are subject to a health or unemployment insurance or who are participating in a pension scheme. There are legal sanctions for misreporting.

As shown by comparisons with Microzensus data, the register covers all employees in the private sector, i.e., almost 80 per cent of total employment in Germany, the remaining 20% consisting of civil servants and self-employed. Individual plants are assigned separate identification numbers even when they belong to the same firm: this makes it possible to trace individual histories of about 2.7 million establishments which have been operating between 1977 and 1990.

Italy

Data are drawn from records of social security contributions collected by INPS (Istituto Nazionale Previdenza Sociale). Each private enterprise with more than one employee is compelled to declare the total number of dependent workers and the total wage bill. There are legal sanctions for misreporting. Each employer is assigned by INPS an identification number. By exploiting these codes, a longitudinal data base has been developed which allows to trace individual histories of all private enterprises operating in manufacturing and services (separate records are kept for agricultural workers) and with at least one dependent employee.

Norway

Data are drawn from the Central Register of Establishments and Enterprises maintained by the Central Bureau of Statistics (Statistisk Sentralbyra) on the basis of tax forms and social security records. The statistical unit is the establishment or physical plant, as opposed to the firm. Data on average yearly (rather than on end-of-the year stocks) dependent employment in each unit is provided. Data used in this study concern only manufacturing, mining and quarrying.

Sweden

As in the case of Norway, data are drawn from the Business Register maintained by Statistics Sweden on the basis of information provided by administrative records (social security records and tax forms). Individual identifiers are provided for both the establishment and the firm. For each unit information is available on the total number of dependent employees. Data cover private employment in all industries excluding agriculture, forestry and fishing.

UK

Data have been assembled by Grey (1993) on the basis of studies using Dun & Bradstreet data. The latter database covers about 400,000 private firms, that is, roughly 70 per cent of total private GDP in the UK The self-employed are not included in the database. Unlike in the case of other longitudinal data sets described above, the statistical unit is the firm, as opposed to the establishment. The undersampling of small units is a major limita-

tion of this database. Procedures followed to improve the representativity of data of the whole universe of private firms in the UK are discussed in Grey (1993).

US

Data are drawn from the US Establishment and Employment Microdata (USEEM) file and the US Establishment and Longitudinal Microdata (USELM) file, both developed by the US Small Business Administration on the basis of Dun & Bradstreet data. As in the case of the UK, data are likely to seriously understate employment in small units. Unlike in the UK, however, identifiers are provided not only for each firm, but also for each establishment, which makes it possible, in principle, to distinguish "true" births and deaths from simple ownership changes.

Notes

* The views expressed herein are those of the author and do not necessarily reflect those of the OECD. The author would like to thank Boyan Jovanovic and an anonymous referee for useful comments on an initial draft.

[1] See OECD (1987) and Grey (1993) for a discussion of cross-country comparability issues related to job turnover statistics.

[2] See Boeri and Cramer (1992) and the appendix for a description of the data base.

[3] Data on total worker flows for Germany provided by the Federal Statistical Office (Reyher and Bach, 1988) are not strictly comparable with job turnover data insofar as the latter concern only private dependent employment, and hence are a lower bound for total job flows. Despite this, changes in the allocation of posts across establishments would seem to account for a large fraction of labour turnover even according to this data source. For instance, in 1987 job turnover was almost 40 per cent of the sum of yearly worker flows.

[4] Dunne, Roberts and Samuelson (1989) applied a similar methodology to decompose "across-cell" and "within-cell" shifts of jobs across US manufacturing units.

[5] Leonard (1988), Dunne, Roberts and Samuelson (1989) and Davis and Haltiwanger (1992) have also found large within industry heterogeneity in US manufacturing data, by using even a richer (4-digits) breakdown of industries.

[6] About one third of both gross job creation and destruction is due to growth rates of establishments in excess of 50 per cent. The average size of these fast growing (or rapidly declining) establishments is about two thirds the average size of incumbents, and hence growth rates in excess of 50 per cent involve, on the average, employment changes equal to one third the average size of incumbents.

[7] As pointed out by Burda and Wyplosz (1993), job turnover is the byproduct of the heterogeneity not only of firms but also of workers. Yet, most of the effects of workers' heterogeneity are unlikely to be captured by job turnover data. Insofar as the latter do not identify individual posts within a plant. Moreover, permanent changes in the size of plants – as those highlighted by job turnover data – are unlikely to be originated mainly by workers' heterogeneity. Rather, they seem to reflect varying degree of efficiency across firms in the same industry. Hence, theories of workers' heterogeneity offer little guidance in identifying testable sources of job turnover.

[8] Davis and Haltiwanger (1992) and Violante and Prat (1992) found also a large heterogeneity of establishment-level outcomes within the same cohort.

[9] See Boeri (1992) for a formal derivation.

[10] In the certainty case the distribution of firms over the quality spectrum would be degenerate.

[11] Whether firms hire a new worker or simply retrain the existing one is ultimately immaterial in this model as long as the firm continues to operate. The focus is, indeed, on job – as opposed to labour – turnover.

[12] The price of the "homogenised" good is itself a function of the number and distribution of firms over the quality spectrum, i.e., of the measure μ introduced below.

[13] By symmetry of the problem, the value of being at $z = 0$ must be positive if some firms were previously located at $z = 0$. Otherwise, there would be a complete replacement of firms whenever σ changes.

[14] See Berry (1971).

[15] By adding and subtracting $1/n$ to P_j, where n represents the number of four-digits products in each sector, P_j can be rewritten as:

$$\frac{1}{2}\left(1 - \frac{1}{n}\right) + \Sigma_i \left(\frac{1}{n^2} - s_i^2\right)$$

The first term within brackets is clearly increasing in n, whereas the second term – a sort of Herfindahl index – is bounded between $-(1 - 1/n)$ and 0, the latter being attained when all products have the same employment share.

[16] In particular, for *all establishments* in our data set we could distinguish the following six categories of workers' educational attainments: primary, primary vocational, secondary, secondary vocational, higher without university degree, and higher with university degree. It should be stressed that for each 3-digits industry we had at least 100 observations (that is, 100 establishments), which suggests that sampling error should not have affected our measures of technological distance across the different products.

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