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Competition, Market Structure and Job Turnover[1]

by

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Abstract

Data for rates of job turnover among plants in the Swedish economy in 1986-97 imply that in a typical year in a representative industry one out of six jobs disappeared, and a corresponding number of jobs were created. Job turnover is counter-cyclical, with no trend, and is higher for skilled jobs, and lower in manufacturing, than for all jobs. The rate of job turnover seems to be higher in industries with high rates of innovation and market growth, which may indicate that the volatility of firm specific demand and supply shocks is higher in such industries. Moreover, for given shocks, turnover is higher in industries with many small plants and low return on capital. The results support the hypothesis that market shares are more stable, and thus reallocation of jobs limited, in industries where firms have strong market power. Finally, there is less job turnover in export oriented industries where foreign ownership is widespread. Firms selling in many markets and/or producing in different locations may be able to even out the employment effects of shocks specific to individual markets and/or locations.

Keywords: Job turnover; Market structure; International competitiveness

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Competition, Market Structure and Job Turn-over

1. Introduction

In open economies shifts of demand among products as well as changes in international competitiveness of domestic producers results in a continuos process of restructuring of production and employment among firms and industries. Jobs disappear in some firms whereas new jobs are created in others.

This paper studies the process of reallocation of jobs among plants in the Swedish economy in 1986-97. In particular, we focus on the issue why rates of job turnover on the plant level is higher in some industries than in others. We attempt to explain these differences in terms of variables reflecting the frequency and volatility of firm and plant specific demand and supply shocks, and in terms of characteristics of the product, the production process and the market which may be expected to be linked to the size and speed of adjustment to such shocks.

2. Concepts and definitions

Following Davis et al. (1996) we define job creation and job destruction as changes in employment on the plant level from one period (year) *t-1* to the next *t*. Job creation in the *i*th industry ($i = 1..m$) is defined as the sum of employment changes in expanding plants (existing in both *t-1* and *t*) plus employment in plants entering the industry (existing in *t* but not in *t-1*), whereas job destruction is the sum of the absolute values of employment changes in contracting plants (existing in *t* and *t-1*) plus employment in plants closing down (existing in *t-1* but not in *t*)[1]. Dividing all plants in the *i*-th industry into four groups: expanding ($j = 1..V_i$), contracting ($j = 1..K_i$), entering ($j = 1..E_i$) and exiting ($j = 1..N_i$), we have

$$C_{it} = \sum_{j=1}^{V_i} \left(L_{ijt} - L_{ijt-1} \right) + \sum_{j=1}^{E_i} L_{ijt} \tag{2.1}$$

$$D_{it} = \sum_{j=1}^{K_i} \left| L_{ijt} - L_{ijt-1} \right| + \sum_{j=1}^{N_i} L_{ijt-1} \tag{2.2}$$

where L_{ijt} denotes employment in the *j*-th plant in the *i*-th industry in year *t*. Dividing with industry employment (following Davis et al (1996) we use the average for *t* and *t-1*)

[1] See also Davidsson et al. (1996) and Zetterberg (1997).

$$L_i^* = 0.5(L_{it} + L_{it-1}) \tag{2.3}$$

gives the rates of job creation (*c*), separated into rate of expansion (*v*) and rate of entry (*e*), and of destruction (*d*), the sum of rates of contraction (*k*) and exit (*n*):

$$c_{it} = \frac{\sum_{j=1}^{V_i}(L_{ijt} - L_{ijt-1})}{L_{it}^*} + \frac{\sum_{j=1}^{E_i} L_{ijt}}{L_{it}^*} = v_{it} + e_{it} \tag{2.4}$$

$$d_{it} = \frac{\sum_{j=1}^{K_i}\left|L_{ijt} - L_{ijt-1}\right|}{L_{it}^*} + \frac{\sum_{j=1}^{N_i} L_{ijt-1}}{L_{it}^*} = k_{it} + n_{it} \tag{2.5}$$

The rate of job turnover or gross job reallocation (Davis & al. 1996) in the *i*-th industry equals the sum of the rates of job creation and destruction:

$$g_{it} = c_{it} + d_{it} = v_{it} + k_{it} + e_{it} + n_{it} \tag{2.6}$$

The overall rate of job reallocation in the economy, i.e the sum across all plants in the economy of absolute employment changes on the plant level, divided by total employment, may be written as a weighted average of the g_{it} s:

$$g_t = L_t^{*-1}\sum_{i=1}^{m}\sum_{j=1}^{M_i}\left|L_{ijt} - L_{ijt-1}\right| = \sum_{i=1}^{m}\ell_{it}\, g_{it} \tag{2.7}$$

where $\ell_{it} = L_{it}^* / L_t^*$ is the share of total employment of the *i*th industry (average for *t* and *t-1*), *m* the number of industries and M_i the total number of plants in the *i*-th industry, including expanding, contracting, entering and exiting plants.[2] The decomposition of job turnover in (2.6) holds also on the aggregate level:

$$g_t = c_t + d_t = v_t + k_t + e_t + n_t \tag{2.8}$$

Rates of job reallocation could be calculated for groups of workers by e.g skill category. Using (2.7), the sum of changes in employment of e.g skilled workers on the plant level is divided by the total number of skilled workers in the economy.

[2] For the last two, either L_{ijt} or L_{ijt-1} equals zero.

3. Job turnover: the data

Data on employment by plant are obtained from the database ÅRSYS (Statistics Sweden), covering all plants in the economy 1986-97. A central concern for the accuracy of our estimates of exit and entry of plants is the validity of the plant identity. According to Statistics Sweden, the code number of a plant may change if two of the following conditions are fulfilled, namely change of ownership or legal form, address or industry classification. New code numbers may emerge or old disappear in connection with mergers or split-ups of firms. A manual check is performed by Statistics Sweden on plants above a certain size to make sure that the appearance or disappearance of code numbers correspond to ”real” exits and entries. Nevertheless it may be the case that our figures for entry and exit are overstated.[3]

In some cases employees are registered by firm but not by plant. This happens especially for activities where the plant concept is ambiguous or not applicable, such as for part of the building industry. In the material, all such workers are aggregated under the plant code 0 and thus fall outside of this study. The proportion of total employment with missing plant code varies around 9 percent and is falling over time.

In most cases it is not possible to adjust for potential measurement errors mentioned above, nor to quantify their importance. However, we have attempted to correct for one particular kind of error, namely the case where a plant existing with a certain code number in year t-1, for some reason is not coded under the same number in year t, and then reappears in year t+1 under the original code number. [4] Such cases have been treated as continuing plants, and employment for t has been intrapolated from the values for t-1 and t+1. The effect of this correction, compared to the alternative of treating such cases as a combination of an exit in t-1 and an entry in t+1, is to lower the calculated entry and exit rates, except for the first (1986-87) and last (1996-97) year where this correction could not be made. The proportion of workers concerned varies around one percent.[5]

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[3] Persson (1998) attempted to correct for such changes of code numbers which did not correspond to any ”real” mobility of workers by examining the actual identity of workers in the ”new” and ”old” establishment: if a major proportion of workers were identical the case was not classified as a combination of exit and entry. Results indicated a substantial reduction of the entry and exit figures obtained by counting all cases of “uncorrected” code number changes. Moreover, changes in rules of taxation 1991 and 1994 resulted in apparent changes in the number of plants registered without any “real” entries or exits taking place, mostly affecting very small (one person) plants (Davidsson & al. 1996).

[4] This may happen if data for the plant are not reported, or erroneously reported under the code number 0, or if there actually has been no activity during that year; according to Statistics Sweden the first two cases are most frequent.

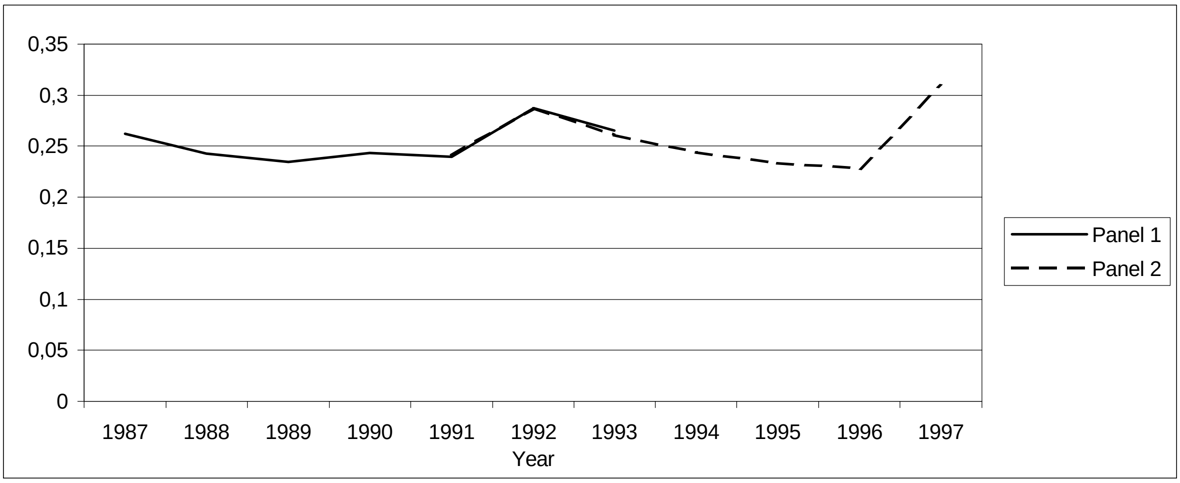
[5] In principle, one might treat plants changing industry code as a combination of an exit in *t-1* in the “old” industry and an entry in *t* in the “new”. Reclassifications may occur as an effect

In the econometric analysis our dependent variable is the job gross realloca-tion rate by industry from one year to the next, g_{it} according to (2.6). Plants are classified by 5-digit industry for 1986-93 according to the SNI69 (identical to the ISIC to the 4-digit level) and for 1990-97 according to the SNI92 (which is based on the NACE). Since it has not been possible to translate one classi-fication into the other, we work with two different but partly overlapping data panels, one for 261 industries in 1986-93, the other for 506 industries in 1990-97. The calculations described below are performed on both panels.

4. Job turnover in Sweden by sector and educational background

Figure 4.1 shows the overall rate of gross job reallocation in the Swedish economy 1986-97, calculated according to (2.7) as a weighted average of industry rates. There is no time trend in job turnover, which did peak in 1991-92, coinciding with the recession, but declined thereafter. As explained in the data section, the increase in the last year, 1996-97, may be somewhat exaggerated, influenced by “false” exits which could not be corrected for. However, judging from previous years this error is much too small (around one percent) to explain but a minor part of the increase.

Figure 4.1 Rate of gross job reallocation in Sweden 1986-97



of plants shifting their production structure, since classification is based on the main product. However, according to Statistics Sweden most reclassifications are simply corrections of previous errors. Thus we have chosen to neglect changes of SNI classification between any

Table 4.1 Job turnover on the Swedish labor market 1986-97. Gross job reallocation rates, by sector and level of education. Unweighted averages of rates by industry and year.

	1986-93		**1990-97**	
	Mean	**Std. dev.**	**Mean**	**Std. dev.**
All jobs	0.283	0.182	0.309	0.242
within		0.126		0.167
between		0.135		0.205
Manufacturing	0.216	0.155	0.227	0.224
Post-secondary	0.419	0.254	0.397	0.295

According to Table 4.1, the overall rate of job turnover (measured here as an unweighted industry average) increased slightly from 1986-93 to 1990-97. The mean values in the table – around 0.3 – implies that on an annual basis, and assuming total employment constant, almost one out of six jobs disappeared and a comparable number was created in the typical industry. The rate of turnover of skilled jobs, defined as changes in employment of workers with a post-secondary education, has been almost twice as high as for jobs in general. Finally, job reallocation in manufacturing has been much lower than the overall rate for the Swedish economy.

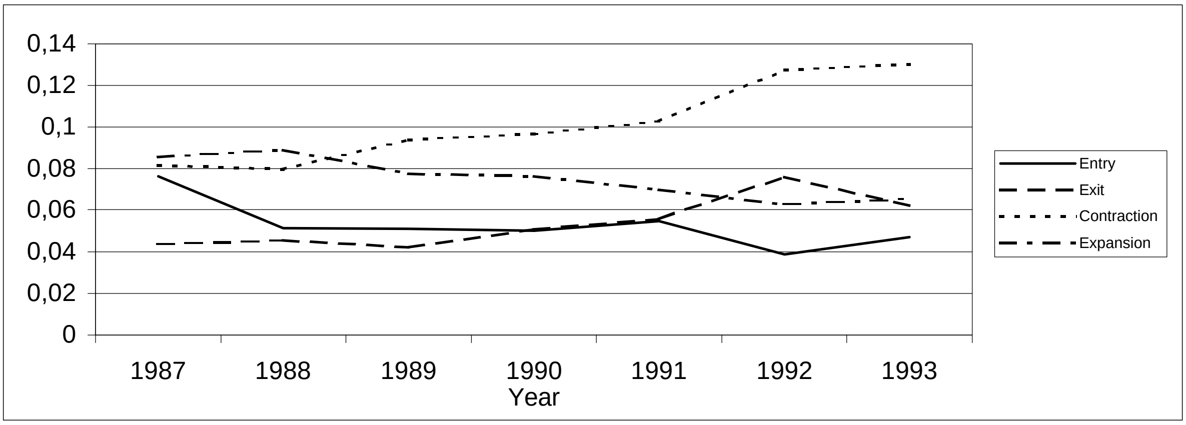
Both the standard deviation over time and across industries increased from 1986-93 to 1990-97. The variation in average rates of job turnover among industries (the ”between” component in table 4.1) has been somewhat higher than the variation over time in the typical industry (the ”within” component). The latter is, however, higher than the standard deviation – the volatility over time – of the aggregate rate of job turnover as calculated from (2.7) and shown in figure 4.1, which is 0.09. Thus, the volatility of job reallocation over time is higher on the micro level, for the typical industry, than at the macro level. To the extent that the industry specific time patterns of turnover activity are uncorrelated, variations tend to cancel out by aggregation.

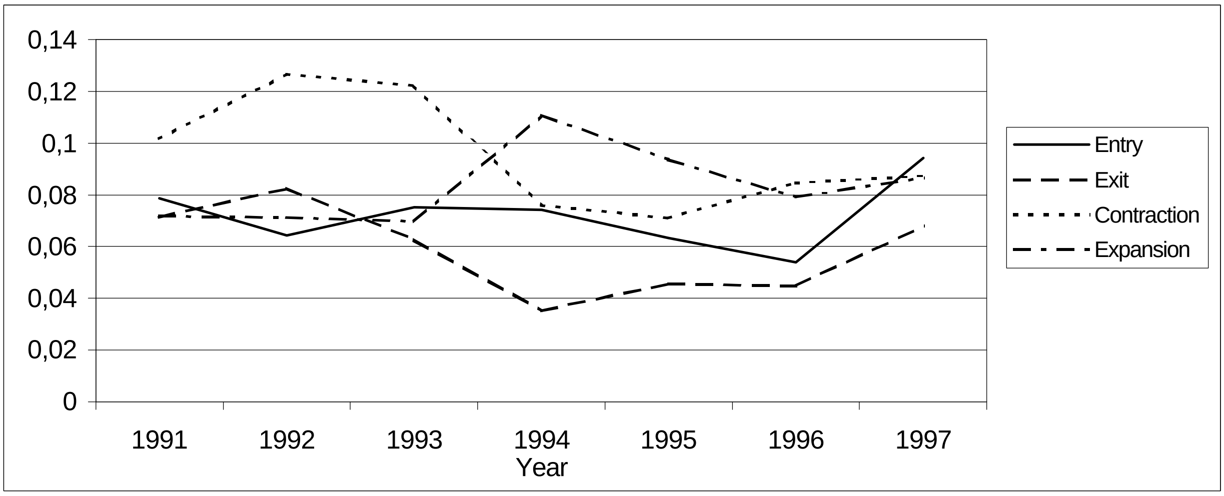
two years, treating the plant as a continuing one, allocating changes of employment to the “new” industry.

5. Components of job turnover: entry, exit, expansion and contraction

Figure 5.1 and Table 5.1 show the components of gross job reallocation, i.e job creation and destruction decomposed into creation of jobs in existing plants and entry of new plants, and destruction of jobs in existing plants and exit of plants according to (2.4) and (2.5); the figures are unweighted averages. Turnover of jobs in Sweden in the typical industry is dominated by expansion and contraction, i.e changes of employments in existing and continuing plants, rather than by exit and entry of plants.[6]

Figure 5.1 Components of job turnover 1986-97





Note: The value for e.g 1987 shows the rate of gross job reallocation (as an unweighted average across industries) from 1986 to 1987.

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[6] Moreover, as explained in **3** the role of exits and entries are probably overstated due to measurement errors.

Table 5.1 Components of job turnover on the Swedish labor market 1986-97. Rates of expansion, contraction, exit and entry. Unweighted averages of rates by industry and year.

	1986-93	**1990-97**
Expansion	0.075	0.083
Contraction	0.101	0.096
Exit	0.056	0.059
Entry	0.051	0.072
Total	0.283	0.309

There are no clear trends over the whole period. Contraction and exit both rise in 1986-93, and expansion and entry both fall, but this is reversed in the following years. With regard to the cyclical pattern, both components of job creation – expansion and entry – fell during the boom of the late 1980s, reaching its lowest level in the recession of 1991-92; expansion peaked in the recovery period 1993-94. Both contraction and exit did peak in the recession, but the former was in absolute terms the more important. Both exit and entry increased strongly in the last year.

Thus the rate of job turnover in Sweden

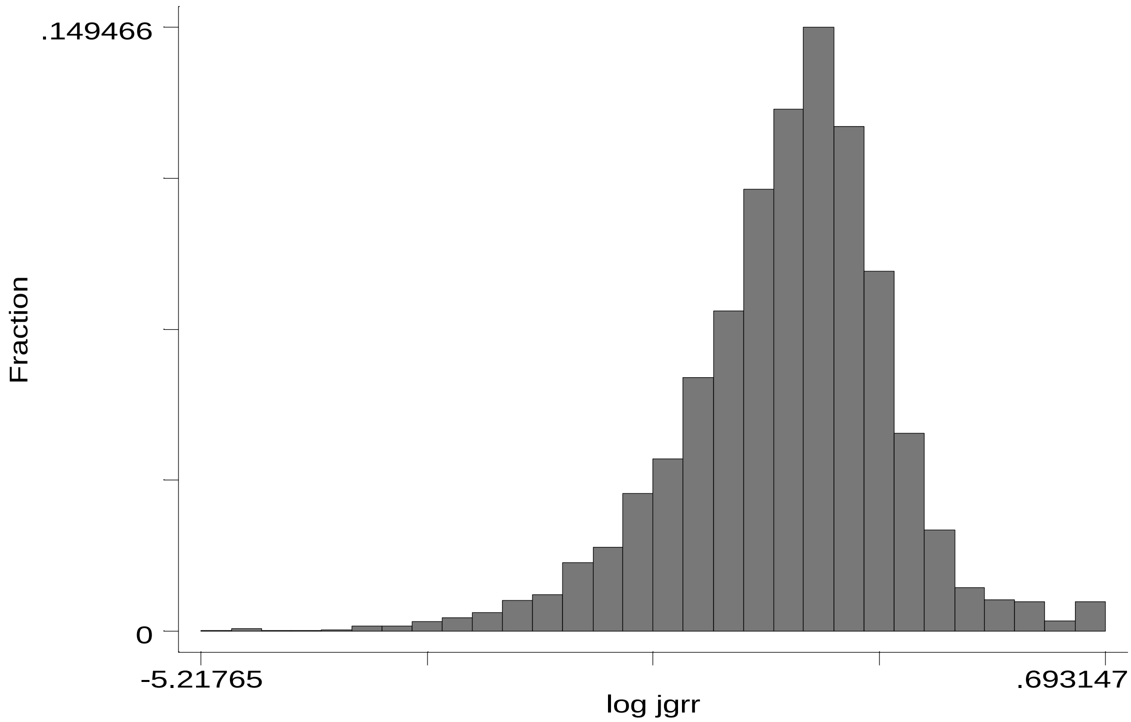
1. is counter-cyclical
2. has no trend
3. is higher for skilled jobs
4. is lower in manufacturing
5. is dominated by expansion and contraction in existing plants rather than by exits and entries.

These observations by and large confirm results of previous studies of job turnover on the Swedish labor market, such as Davidsson et al. (1994, 1996), Persson (1999) and Andersson et al. (2000); however, the latter study finds a clear positive trend for the rate of job turnover, although for a longer time period (1965-97) and only for job turnover among manufacturing industries, i.e inter-industry job reallocation.[7]

On the micro level, rates of job reallocation varies not only over time but also among industries. Figure 5.3 shows the frequency distribution of $\ln g_{it}$ according to (2.6). In order to be able to explain the variation in rates of job turnover we develop a framework for the analysis in the next section.

[7] That is, intra-industry turnover among plants in the same industry is not included.

Figure 5.3 Frequency distribution of rates of job reallocation by industry and year, 1990-97



6. Determinants of job turnover: a theoretical framework

6.1 Volatility of demand and supply shocks

Assume an industry with monopolistic competition. Firms[8] produce differentiated products but are otherwise identical in the long run, in the sense that the non-stochastic parts of demand and cost functions are identical and constant. In the short run, however, the representative firm is exposed to firm specific random demand (e_{ijt}) and supply (t_{ijt}) shocks, with mean equal to one and constant variance, shifting the demand and production functions. Assuming that labor in the short run is the only mobile factor, and that the firm acts as price taker in the labor market, optimal employment is determined such that the marginal revenue product of labor equals the wage rate:

$$e_{ijt} F_i(q_{ijt}) t_{ijt} f_L(L_{ijt}) = w \tag{6.1}$$

[8] In this model we assume that each firm consists of no more than one plant.

where $F_i(\cdot)$ and $f_L(.)$ are the constant, non-stochastic parts of the marginal revenue and marginal productivity of labor functions. The firm adjusts employment and output to these shocks so that (6.1) is always satisfied. From (6.1) it is obvious that, given $F_i(.)$ and $f_L(.)$, the effects on employment will be larger, the larger the shocks.

The size of these adjustments for given shocks depends on the slopes of $F_i(\cdot)$ and $f_L(.)$. The more elastic the demand for the output of the representative firm and the slower the marginal product of labor falls with increasing employment, the higher will be the firm´s elasticity of demand for labor, and the more volatility in sales and employment one should expect, given the distribution of supply and demand shocks. This means that if we compare industries exposed to stochastic shocks with the same variance, we should expect the rate of job reallocation among firms to be higher, the more elastic the $F_i(\cdot)$ and $f_L(.)$ curves of the representative firm.

Since we cannot measure demand and supply shocks directly, our empirical analysis is more limited in scope. We ask two questions. First, which industries are likely to be exposed to high volatility with respect to firm specific demand and supply shocks, i.e large variance of e_{ijt} and t_{ijt}? And second, given the patterns of demand and supply shocks, in which kind of industry should we expect to observe the largest effects in terms of reallocation of employment among plants? The answer to that is a matter of the elasticities of the marginal revenue and marginal productivity of labor schedules. However, since these elasticities cannot be measured directly, what we actually do is to explore the relationship between the rate of job turnover and a set of industry characteristics expected to be related to these elasticities.

One may expect to find a higher volatility for both demand and supply shocks in product groups in the early stages of the product life cycle, rather than in more mature industries. Besides high rates of growth of market demand, such industries are typically characterized by high rates of innovation, resulting in high rates of product quality improvement and productivity growth, and differentiated demand where fashion and brand images are important, thus making both supply and demand conditions inherently unstable.

Should we expect more job turnover in industries exposed to foreign competition – in home or export markets – than in sheltered sectors? The answer is yes if we assume that – for some reason – shocks shifting demand and/or relative productivity among firms on average are larger in such industries than in sheltered sectors. If, on the other hand, demand shocks are specific not to the firm but mainly to the market, and the shocks are uncorrelated across markets, it may well be that employment in an export oriented firm, spreading its sales over many markets, may fluctuate less than for a firm with purely domestic sales, since market specific shocks will cancel out with respect to total sales and employment.

The forms of ownership may matter for job turnover. Provided that changes in employment are costly – there are costs associated with both hiring and firing – a multinational firm may choose to even out market specific demand variations by intra-firm trade, thus keeping production and employment at each location unchanged. This line of argument is basically the same as that applied to exporting firms. Finally, if publicly owned firms are more sensitive to political pressure not to fire workers when sales and profits fall, industries with a high proportion of public ownership may show lower job turnover.

6.2 Elasticity of labor demand

The Marshall (1890) rules state that the elasticity of demand for labor of a firm will be higher, the higher the elasticity of substitution of labor for other factors of production, the higher the share of wages in total cost, i.e the lower the capital intensity, and the more elastic the demand for the firm´s product (Sapsford & Tzannatos 1993). When the number of firms is large, the price elasticity of demand for the product of the representative firm equals the elasticity of substitution between each pair of products in the industry (Helpman & Krugman 1985). Thus, $F_i(\cdot)$ is more elastic the closer substitutes – i.e. the less differentiated – products are. However, product differentiation is notoriously difficult to measure (Caves & Williamson 1985).

If the number of firms is small, the perceived elasticity of demand will reflect the firm´s conjectures about the reactions of its competitors to changes in its price and/or sales. In the case of Cournot competition among identical firms, it may be shown (Richardson 1989) that the demand elasticity of the firm will be proportionate to the number of sellers. Using a simple model where labor in the short run is the only mobile factor, we show in the Appendix that the rate of job turnover in an industry with Cournot oligopoly, for given shocks, will increase with the number of firms and with wages´share of costs.

In general, perceived demand will be inelastic if firms expect competitors to follow their price changes (Helpman & Krugman 1989). Awareness of such retaliation should be more likely in highly concentrated industries with few sellers. A tendency for higher market share stability in concentrated industries was found for the U.S. by Gort (1963) and Caves & Porter (1978), and for Canada by Baldwin & Gorecki (1994); see also Schmalensee (1989).

Given the patterns of stochastic shocks, the stability of market shares of firms within an industry may be expected to be higher in industries where there is some form of collusive behavior. According to Tirole (1988) and Jaquemin & Slade (1989), tacit collusion will be simpler to enforce, and thus should be more frequent, in strongly concentrated industries.

A high level of profitability in an industry may be another indicator of limited competition. Thus we would expect low rates of job turnover in industries with a high average rate of return on capital. When assessing this relationship, however, it will be necessary to control for other factors influencing both job turnover and profits, such as demand growth and improvement of competitiveness.

The rate of job reallocation is affected also by the rates of entry and exit of firms. High barriers to entry are likely to be found in capital intensive production with strong economies of scale and high minimum efficient scale (MES), and therefore with high initial investment requirements which may imply high sunk costs and thus more risky projects (Devine et al. 1985, Tirole 1988). Lacking proper measures of MES of plants, and assuming a market outcome where the actual distribution of plant size in an industry will be concentrated around the MES, we may use average plant size as a proxy. A negative relationship between plant size and entry of new firms was found for Sweden by Hause & Du Reitz (1984).

6.3 Labor mobility and job turnover

Could differences in rates of job turnover among industries be explained by differences among groups of workers in mobility and propensity to change jobs? After all, the response to a given impulse to reallocate jobs must be influenced by rigidities limiting labor mobility. Should we expect e.g industries with a high proportion of skilled workers to show higher rates of turnover? Studies of labor mobility in Sweden by e.g Holmlund (1984) found quit rates falling with seniority and rising with urbanization and education.

The employment response to firm specific shocks will, at least in the short run, depend on the degree to which the skills acquired by work experience is firm specific. The higher the proportion of workers in an industry possessing such skills, the slower adjustment to external shocks should be.

It is an open question whether the degree of firm specificity of such learning-by-doing is higher or lower for workers with a higher education. It would be higher if such workers could be thought of as occupying jobs involved in the development of firm specific technologies, product designs etc, where learning may be seen as a continous process closely linked to the experiences of a particular firm. On the other hand, career prospects may improve with changes of employment if this increases the rate of acquisition of (non-specific) knowledge and experience; this effect may be more important for workers with a strong educational background.

7. *Explanatory variables and estimation methods*

7.1 Explanatory variables – the data

For the explanatory variables we use data on employment by plant, industry and level of education from the ÅRSYS data base (Statistics Sweden). From the Financial Statistics (Statistics Sweden) we obtained data by firm on exports and total sales, R&D, ownership, capital stocks and profits, which were aggregated up to the industry level.

We have argued that market shares will be more unstable, and job turnover higher, for products in an early stage of the product life cycle. To characterize industries as "new" or "mature" we would need measures of the rate of product innovation as well as of the rate of growth of (world) demand. We have proxied these by the R&D intensity (*R*) and the rate of growth of employment (*G*). Obviously the latter measures not only market growth but also changing competitiveness of Swedish producers.

Another hypothesis was that the number of sellers and/or seller concentration, reflecting the intensity of competition, was related to the perceived elasticity of demand for the product of the representative firm and thus to the employment response to given shocks. Lacking an appropriate measure of seller concentration which includes sellers of imported goods, we have used the number of plants in the industry (*N*). To capture the effect on job turnover of entry barriers we used average plant size measured by employment (*S*). As indicators of limited competition we also use the industry averages for profit margin (p_1) and return to capital (p_2). The export orientation, skill intensity and ownership variables, finally, are defined as export sales in per cent of total sales, share of employment with post-secondary education, and share of labor force employed in foreign owned and publicly owned firms, in each industry.

The distributions of the independent variables are in most cases strongly skewed; some outlier values may be due to measurement errors. We address this problem by estimating robust regressions where influential values are weighted down. Correlations among independent variables are generally low (the highest, between export share and plants size, is 0.35).

7.2 Hypotheses

From the discussion we expect the rate of gross job reallocation in an industry g_{it} to:

1. increase with the number of plants in the industry *N*, where few plants is supposed to reflect seller concentration and market power of firms, as well as

the likelihood of tacit collusion, resulting in inelastic demand curves and a high stability of market shares;

2. decrease with average plant size *S*, reflecting minimum efficient scale, and with average capital intensity *C*, both implying high entry barriers in the form of large initial investment; moreover, capital intensity is inversely proportional to elasticity of labor demand and thus to the employment effects of given shocks;

3. decrease with p, the average rate of profit, measured either by p_1, profits as share of sales, or p_2, rate of return on capital, both reflecting strong market power of firms;

4. increase with R, the R&D intensity, indicating an industry with a high rate of innovation, creating instability of technology and demand patterns, and with the rate of employment growth *G*, so far as this reflects growth of market demand and thus stages in the life cycle of the product;

5. fall with the proportion of public ownership in the industry, assuming that state owned firms are exposed to political pressure not to reduce employment. Job turnover g_{it} may rise or fall with

6. the proportion of workers with a post-secondary education (*H*), export share of sales (*X*) and the share of foreign ownership in the industry (*F*), depending on which of a set of conflicting hypotheses turns out to be most relevant.

7.2 Estimation issues

The distribution of g_{it}, our dependent variable obtained from (2.6), is strongly skewed, while the logarithm of g_{it} comes closer to a normal distribution. Moreover, g_{it} is bounded within the interval $0 \leq g \leq 2$. To ensure that our predicted values from the regressions fall within this interval, we use a logistic functional form (Kmenta 1971) which we linearize to obtain:

$$g = \ln\left(\frac{g}{2-g}\right) = \mathbf{x}\beta + e \tag{7.1}$$

where β is a vector of regression coefficients which may be estimated by OLS. As it turns out, g_{it} is approximately normally distributed.

We proceed to estimate a model of the general form

$$g_{it} = a + \mathbf{x}_{it}\beta + u_i + e_{it} \tag{7.2}$$

where β is a vector of coefficients to be estimated, u_i the industry specific residual and e_{it} a time-and-industry variant residual with the commonly assumed properties. From (7.2) we have that

$$\bar{g}_i = a + \bar{\mathbf{x}}_i\beta + u_i + \bar{e}_i \tag{7.3}$$

$$(g_{it} - \bar{g}_i) = (\mathbf{x}_{it} - \bar{\mathbf{x}}_i)\beta + (e_{it} - \bar{e}_i) \tag{7.4}$$

A fixed effect or within estimator of β is obtained by OLS on (7.4) while (7.3) gives the between estimator. However, it may well be the case that the transitory or short run effects of changes in ***x*** are different from the long run or permanent effects; thus (7.2) is replaced by

$$g_{it} = a + \bar{\mathbf{x}}_i\beta_1 + (\mathbf{x}_{it} - \bar{\mathbf{x}}_i)\beta_2 + u_i + e_{it} \tag{7.5}$$

so that the within regression estimates the transitory effects β_2 and the between regression the long run effects β_1, where the coefficients are in general different. The random effects estimator is a weighted average of the coefficients produced by the within and between estimators; both the random and between estimators require that u_i and $\bar{\mathbf{x}}_i$ are uncorrelated. As should be clear from the discussion we will mainly focus on the long run or permanent relationships with job turnover.

In equations explaining job turnover from period *t-1* to period *t*, the explanatory variables refer to period *t-1*.

8. Determinants of job turnover: the empirical results

8.2 Estimation methods

Tables 8.1, 8.2 and 8.3 show the results from a set of regressions explaining the variation in rates of gross job reallocation among industries on the 5 digit level and over time for the periods 1986-93 and 1990-97. OLS regressions using pooled time series and cross section data explain one fifth to one quarter of total variation and are strongly significant. The model explains more of the between industry variation –one third to one half – than of the within-industry (i.e over time) variation. Cook-Weisberg tests indicate heteroskedasticity. However, reestimation with robust standard errors, corrected using the Huber-White method, does not change the qualitative results (sign and significance of coefficients), except that significance is lost for profit margin in both panels and for R&D share in the first, and return on capital in the second panel.

Nor are the qualitative results changed much by using robust estimation where influential observations (outliers) are given less weight. The effect in the second panel is that the growth, R&D and capital intensity variables, being insignificant in the OLS regressions, all become negative and significant in the robust regression,[9] whereas public ownership looses significance; in the first panel, significance drops for foreign ownership and profit margin but goes up for return on capital and R&D share.

F tests indicate that industry fixed effects are significant. According to a Breusch-Pagan test the hypothesis that these effects are constant over time may be rejected. The Hausman test indicates that random effects estimates differ significantly from fixed effects estimates. This is not surprising since the latter may be interpreted as a temporary or transitory effect while the between-industry estimates correspond to a long run or permanent effect, and the two may well be different. Thus the model in (7.2) may be misspecified. The approach we have followed here is to replace (7.2) with (7.5).

In table 8.3 we present the result of estimating equations where the original variables $\mathbf{x}_{it}$ have been replaced by $\bar{\mathbf{x}}_i$, the industry mean over the period, and $(\mathbf{x}_{it} - \bar{\mathbf{x}}_i)$, the deviation for each year. The Hausman statistic is substantially reduced, especially in panel 1, where the hypothesis that fixed and random effects estimates are the same can no longer be rejected. In many cases, the estimated long run or permanent effects, i.e the coefficients for the industry means in (7.5), correspond closer to the hypotheses advanced than do the short run effects, the exceptions being growth and skilled labor in panel 1 and profit margin in panel 2.

8.2 The role of competition and market structure

Job turnover has been high in industries with many small plants, measured by average employment per plant. The effect of plant size is negative and strongly significant in all specifications except the fixed effect regression for the second panel. Likewise, the coefficient for the number of plants in the industry is positive and significant (on at least 10% level) in all specifications exept the fixed effect regressions. In particular, the permanent effects of these variables are significant, confirming the hypotheses.

Our interpretation is, first, that a large average plant size, indicating a large minimum efficient scale of production in the industry, reduces job turnover by acting as a barrier to entry (and/or exit). Second, we believe that a large number

[9] Or in other words that outlier observations tend to obscure the importance of these variables.

of plants may reflect a low level of seller concentration on the Swedish market and thus a highly competitive market where demand for the representative firm is highly elastic, which, other things equal, should result in a high rate of job turnover.

Rates of job turnover are low in industries with high average rates of profit, measured as profit margin, i.e profits in per cent of sales, or as return on capital; both coefficients are negative and mostly significant, especially for the profit margin.[10] This supports the idea that high profits in this context reflects limited competition,[11] which in turn implies stability of market shares.

Job turnover is slow in export oriented industries and industries with a high rate of foreign ownership. The coefficients for these variables are negative and strongly significant in all specifications except the fixed effect equation for the first period; in particular, the permanent effects are negative and significant. Thus there is no evidence for the hypothesis that the volatility of firm specific demand shocks should be higher in export markets. Rather, the results may be interpreted in terms of the ”pooling of shocks” argument, i.e that if firm specific demand shocks are uncorrelated across markets, employment in a firm or industry where sales are spread over a number of foreign markets should show less volatility than for firms that only sell to the home market.

The same type of interpretation may be applied to foreign ownership. The permanent effects of foreign ownership on job turnover are negative and strongly significant. A multinational firm may be in a position to avoid costly adjustment of local employment to fluctuations in local demand by intra-firm trade. There is also some evidence for the hypothesis that public ownership in an industry tends to reduce the rate of job turnover, in particular in the first period.

8.3 Job turnover in the product cycle

There is some tendency for rates of job reallocation to be higher in industries with high rates of innovation, as measured by the R&D intensity, but this holds only in the first period and for the robust and long run estimates; in the second period, the R&D coefficient is mostly negative. Thus the hypothesis that R&D intensive industries, by assumption exposed to high volatility of firm specific shocks both to supply and demand, should show instability of market shares of firms and high rates of job turnover, obtains only limited support.

[10] However, it is possible that the negative sign mainly reflects the short term relationship, capturing the counter-cyclical behaviour of job turnover, especially in the second period (cf table 8.3).

[11] Note that this is a partial effect, controlling for other variables related both to turnover and profits, such as growth and export performance.

Industries with high rates of employment growth tend to show high rates of job reallocation. The effect is strongly significant in the first period in all equations except the between-industry regression. In the second period the results are mixed; however, the permanent effect is positive and strongly significant. The combination of negative within-industry and positive between-industry coefficients could perhaps be interpreted as if the first result captures the short run counter-cyclical pattern of job turnover, while the second reflects the long run relationship. Thus there seems to be some support - although limited – for the idea that rates of job turnover are higher in industries in early stages of the product life cycle, i.e with high long run average rates of market growth.

The results for the variables capital intensity and skilled labor are less clearcut. The skill variable is positive and significant but mostly in the second period; the permanent effect is not significant. To some extent the skill variable may pick up the same thing as the R&D variable, namely high rates of turnover of technical and commercial knowledge, making market shares unstable.

There is little support for a link between capital intensity and job turnover via the elasticity of labor demand. However, part of this effect may have been picked up by the profit margin variable, which is negative and significant as predicted, especially in the second period.

9. Conclusions

In this paper we attempt to explain the variation of rates of job reallocation across industries and over time by a limited set of industry characteristics. We find, first, some support for the idea that the volatility of firm specific demand and supply shocks, affecting firms´ competitiveness, is higher in industries with high rates of innovation and market growth, i.e in early stages of the product life cycle. Second, the employment responses to given shocks seem to be smaller in concentrated industries with limited competition.

We find no evidence for the view that job reallocation is faster in industries exposed to foreign competition in export markets or through foreign ownership of domestic plants. Rather it may be the case that highly international firms, selling in many markets and/or producing in different locations, may be able to even out the employment effects of market and/or location specific shocks.

A general problem with our analysis is the rather loose links between theoretical concepts and actual measurements. One particular concept may be reflected in more than one statistical variable; likewise, one variable may pick up more than one concept. Thus the interpretation of the empirical results should be done with caution.

A more serious defect is that we focus almost exclusively on what one might call the demand side of the industrial restructuring process, i.e on the impact of changing competitiveness of firms on the demand for labor. But actual job turnover is determined also from the supply side of the labor market, involving various determinants of the mobility of workers. In further work it would be interesting to analyze these mechanisms simultaneously, based on an integrated model.

Table 8.1 Determinants of the rate of gross job reallocation in Swedish industries 1986-93

	OLS	*Robust standard errors*	*Robust regression*	*Fixed effect (within)*	*Random effect*	*Between effect*
Growth	*0.282* *(8.86) ***	*(8.50) ***	*0.270* *(10.22) ***	*0.306* *(11.03) ***	*0.299* *(10.95) ***	*0.036* *(0.23)*
Skilled labor share	*-0.023* *(-0.16)*	*(-0.15)*	*0.094* *(0.81)*	*2.091* *(4.05) ***	*0.176* *(0.85)*	*-0.375* *(-1.69)*
Plant size	*-0.186E-2* *(-10.91) ***	*(-6.14) ***	*-0.480E-2* *(-33.87) ***	*-0.156E-2* *(-2.75) ***	*-0.201E-2* *(-7.35) ***	*-0.195E-2* *(-5.94) ***
R&D share	*0.759E-2* *(2.06) **	*(1.49)*	*0.542E-1* *(9.26) ***	*-0.163E-2* *(-0.46)*	*0.243E-2* *(0.72)*	*0.240E-1* *(2.41) **
Nr of plants	*0.117E-4* *(3.16) ***	*(2.65) ***	*0.288E-4* *(9.37) ***	*-0.741E-5* *(-0.51)*	*0.103E-4* *(1.76)*	*0.102E-4* *(1.57)*
Export share	*-0.500* *(-7.34) ***	*(-6.68) ***	*-0.333* *(-5.86) ***	*-0.014* *(-0.08)*	*-0.391* *(-3.90) ***	*-0.521* *(-4.18) ***
Foreign ownership	*-0.216* *(-3.31) ***	*(-2.85) ***	*-0.075* *(-1.39)*	*0.407E-2* *(0.03)*	*-0.094* *(-1.05)*	*-0.319* *(-2.53) **
Public ownership	*-0.303* *(-4.24) ***	*(-3.13) ***	*-0.244* *(-4.09) ***	*0.874E-1* *(0.60)*	*-0.133* *(-1.40)*	*-0.367* *(-2.74) ***
Profit margin	*-0.434* *(-2.84) ***	*(-1.86)*	*0.337E-1* *(0.24)*	*-0.386* *(-1.99) **	*-0.352* *(-2.16) **	*-0.044* *(-0.15)*
Return on capital	*0.330E-1* *(1.74)*	*(0.95)*	*-0.336* *(-9.40) ***	*0.511E-1* *(2.44) **	*0.043* *(2.37) **	*0.272E-1* *(0.95)*
Capital intensity	*0.232E-4* *(1.75)*	*(1.11)*	*0.194E-4* *(1.77)*	*-0.722E-4* *(-2.48) **	*-0.175E-4* *(-0.95)*	*0.488E-4* *(1.93)*
Constant	*-2.125*		*-2.134*	*-2.543*	*-2.189*	*-1.815*
$F(b=0)$	*40.02 ***	*26.89 ***	*201.6 ***	*16.23 ***	*247.8 ***	*11.50 ***
$\bar{R}^2$	*0.218*			*0.119*		*0.337*
Nr of obs	*1593*	*1593*	*1591*	*1593*	*261*	*261*
CookW c^2	*125.7*					
$F(u=0)$				*4.55 ***		
Breusch c^2					*475 ***	
Hausm. c^2					*76.47 ***	

Note: The dependent variable is g_{it} as defined in (7.1). **, * denotes significance on the 1% and 5% levels.

Table 8.2 Determinants of the rate of gross job reallocation in Swedish industries 1990-97

	OLS	*Robust standard errors*	*Robust regression*	*Fixed effect (within)*	*Random effect*	*Between effect*
Growth	*0.143E-1* *(0.17)*	 *(0.07)*	*-0.523* *(-7.04) ***	*-0.209* *(-2.81) ***	*-0.168* *(-2.29) **	*1.706* *(5.35) ***
Skilled labor share	*0.578* *(6.25) ***	 *(5.81) ***	*0.697* *(8.52) ***	*-0.189* *(-0.43)*	*0.328* *(2.22) **	*0.309E-1* *(0.19)*
Plant size	*-0.319E-2* *(-18.86) ***	 *(-8.67) ***	*-0.485E-2* *(-33.65) ***	*0.125* *(2.46) **	*-0.239E-2* *(-8.86) ***	*-0.335E-2* *(-9.91) ***
R&D share	*-0.231E-2* *(-0.28)*	 *(-0.87)*	*-0.410* *(-3.75) ***	*-0.971* *(-1.38)*	*-0.531E-2* *(-0.76)*	*0.874E-2* *(0.28)*
Nr of plants	*0.171E-4* *(3.43) ***	 *(4.37) ***	*0.119E-4* *(2.81) ***	*0.289E-4* *(1.32)*	*0.221E-4* *(2.56) ***	*0.208E-4* *(2.20) **
Export share	*-0.664* *(-13.31) ***	 *(-11.18) ***	*-0.557* *(-13.02) ***	*-0.300* *(-2.59) ***	*-0.651* *(-8.87) ***	*-0.803* *(-7.99) ***
Foreign ownership	*-0.214* *(-4.95) ***	 *(-4.52) ***	*-0.195* *(-5.28) ***	*-0.186* *(-2.47) **	*-0.195* *(-3.39) ***	*-0.201* *(-2.28) **
Public ownership	*-0.162* *(-2.63) ***	 *(-2.25) **	*-0.204E-1* *(-0.39)*	*0.171* *(1.75)*	*-0.126E-1* *(-0.16)*	*-0.243* *(-1.96)*
Profit margin	*-0.445* *(-5.13) ***	 *(-1.92)*	*-0.994* *(-13.05) ***	*-0.423* *(-5.19) ***	*-0.454* *(-5.73) ***	*-0.279* *(-0.97)*
Return on capital	*-0.99E-2* *(-2.26) **	 *(-1.63)*	*-0.415E-1* *(-2.75) ***	*-0.384E-2* *(-1.01)*	*-0.620E-2* *(-1.65)*	*-0.381E-1* *(-2.34) **
Capital intensity	*0.21E-4* *(1.29)*	 *(0.82)*	*-0.312E-4* *(-2.27) **	*0.896E-5* *(0.26)*	*-0.435E-5* *(-0.20)*	*0.481E-5* *(0.18)*
Constant	*-1.909*		*-1.340*	*-1.853*	*-1.711*	*-3.422*
F($b = 0$)	*99.91 ***	*59.24 ***	*235.9 ***	*7.00 ***	*329 ***	*34.38 ***
$\bar{R}^2$	*0.268*			*0.030*		*0.433*
Nr of obs	*3013*		*3011*			
CookW c^2	*422.0*					
F ($u = 0$)				*5.00 ***		
Breusch c^2					*967 ***	
Hausm. c^2					*171 ***	

Note: The dependent variable is g_{it} as defined in (7.1). **, * denotes significance on the 1% and 5% levels.

Table 8.3 Determinants of the rate of gross job reallocation in Swedish industries 1986-93 and 1990-97 – the temporary and permanent effects

	1986-93	*1986-93*	*1990-97*	*1990-97*
	Permanent effect	*Temporary effect*	*Permanent effect*	*Temporary effect*
Growth	*0.203* *(1.44)*	*0.306* *(10.74) ***	*1.441* *(4.89) ***	*-0.186* *(-2.51) **
Skilled labor share	*-0.283* *(-1.33)*	*2.344* *(4.48) ***	*0.182* *(1.09)*	*-0.153* *(-0.39)*
Plant size	*-0.182E-2* *(-6.53) ***	*-0.157* *(-2.71) ***	*-0.189* *(-2.55) **	*-0.185* *(-2.49) **
R&D share	*0.155E-1* *(2.26) **	*-0.787E-3* *(-0.22)*	*0.023* *(0.56)*	*-0.950E-2* *(-1.34)*
Nr of plants	*9.97E-6* *(1.81)*	*-3.76E-6* *(-0.25)*	*0.192E-4* *(2.14) **	*0.329E-4* *(1.50)*
Export share	*-0.517* *(-4.59) ***	*-0.281E-1* *(-0.16)*	*-0.754* *(-8.07) ***	*-0.315* *(-2.71) ***
Foreign ownership	*-0.283* *(-2.54) **	*-0.273E-1* *(-0.21)*	*-0.201* *(-2.31) **	*-0.195* *(-2.62) ***
Public ownership	*-0.379* *(-3.12) ***	*0.122* *(0.82)*	*-0.204* *(-1.66)*	*0.119* *(1.22)*
Profit margin	*-0.468* *(-1.39)*	*-0.263* *(-1.38)*	*-0.249* *(-1.73)*	*-0.433* *(-5.47) ***
Return on capital	*0.526E-1* *(1.67)*	*0.35E-1* *(1.65)*	*-0.046* *(-2.14)*	*-0.398E-2* *(-1.04)*
Capital intensity	*0.151E-4* *(0.74)*	*-0.194E-4* *(-0.81)*	*5.34E-6* *(0.24)*	*0.113E-4* *(0.50)*
Constant	*-1.998*		*-3.040*	
Wald c^2	*330.33*		*468.84*	
$\bar{R}^2$				
Nr of obs	*1593*		*3013*	
Hausman c^2	*14.71*		*26.77*	

Note: The dependent variable is g_{it} as defined in (7.1). **, * denotes significance on the 1% and 5%. The permanent effects correspond to the coefficient vector β_1 in (7.5), the temporary effects to β_2.

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Appendix.

Determinants of job turnover in a simple model.

Assume an industry where n identical firms are engaged in oligopolistic competition of the Cournot kind, i.e each firm assumes the output of its rivals to be given. Demand for the product of the representative firm is

$$q = Bp^{e} \qquad e < -1 \tag{1a}$$

where e is the perceived demand elasticity. It may be shown (Richardson 1989) that in this case e is proportionate to the number of firms:

$$e = nE \tag{1b}$$

where E is the market demand elasticity. The inverse demand function is

$$p = bq^{e} \qquad -1 < e = \frac{1}{e} = \frac{1}{nE} < 0 \tag{1c}$$

and marginal revenue

$$MR = (e+1)bq^{e} \tag{1d}$$

Assume that the production function of the representative firm is Cobb-Douglas in labor and capital:

$$q = AL^{a}K^{1-a} \tag{2a}$$

In the short run, however, labor is the only variable factor of production so the output of the firm is

$$q = AL^{a} \tag{2b}$$

The demand and supply parameters are assumed identical for all firms, so long run average price and output will be the same for all firms. In the short run firms are affected by random shocks p with mean equal to one and constant variance. The variable p may be thought of as a shock either on the demand or the supply side, shifting demand or production functions.

The demand for labor of the representative firm – the profit maximizing value of employment – is given by the condition that the value of the marginal product of labor equals the wage rate, which is exogeneous to the firm:

$$p\,(e+1)bq^{e}aAL^{a-1} = w \tag{3}$$

A demand or supply shock (p deviates from one) implies that the firm adjusts employment L so that (3) is again satisfied. Inserting (2b) we have

$$p\,(e+1)b(AL^{a})^{e}aAL^{a-1} = p\,(e+1)abA^{e+1}L^{ae+a-1} = w \tag{4a}$$

and in logarithms

$$\ln p + \ln H + (ae+a-1)\ln L = \ln w \tag{4b}$$

$$\text{where } H = (e+1)abA^{e+1} \tag{4c}$$

Differentiating, keeping w constant and letting p denote the random shock of the period, i.e the deviation from one,

$$d\ln L = -\frac{1}{ae+a-1}\ln p \tag{5}$$

If all firms initially – i.e before the shocks – have the same employment we may write job turnover in the industry as

$$g = L^{-1}\sum abs(dL_j) = \sum abs(\frac{dL_j}{L_j}\frac{L_j}{L}) = \sum abs(d\ln L_j) \tag{6}$$

since firm´s shares of employment are the same and add up to one. Inserting (5)

$$g = -\left[\frac{1}{ae+a-1}\right]\sum abs(\ln p) = -UV \tag{7}$$

The second part of the expression, V, measures the variability of shocks in a particular industry. The first part, U, measures the effect on job turnover given the shocks.

Since $ae+a-1<0$, $U<0$ and $\frac{dg}{dV}>0$, so that the more variability of demand or supply shocks the more job turnover. For given shocks, job turnover will be higher the higher the (absolute value of the) price elasticity of demand for the product of the representative firm, and the higher the output elasticity w.r.t labor, since

$$\frac{dg}{de} = -V\frac{dU}{de} = -V\left[\frac{-a}{\left(ae+a-1\right)^2}\right] > 0 \tag{8a}$$

which means that

$$\frac{dg}{dn} = \frac{dg}{de}\frac{de}{de}\frac{de}{dn} = \frac{dg}{de}(-\frac{1}{e^2})E > 0 \tag{8b}$$

$$\frac{dg}{da} = -V\frac{dU}{da} = -V\left[\frac{-(e+1)}{\left(ae+a-1\right)^2}\right] > 0 \tag{9}$$

In a long run equilibrium, when all factors are mobile, *a* would correspond to wages share of total cost. Thus, other things equal, job turnover should be high in labor intensive industries with many firms (plants).

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