Job flows in Swedish manufacturing 1972-1996[†]

by

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Abstract

This paper deals with the heterogeneous employment outcome at the plant level in Swedish manufacturing over the period 1972-96.

Non-negligible gross flows of jobs is found to be a pronounced feature in Swedish manufacturing, but as compared to results on U.S. data, the average pace of job reallocation has not been as high. However, masked behind low averages are periods of large-scale job reallocation and, in particular, we find that job reallocation exhibits a counter-cyclical movement.

Little of the observed heterogeneity in the plant-level employment outcome can be explained by easily observable characteristics of the plant. Instead most job reallocation takes place within narrowly defined sectors of the manufacturing sector. Furthermore, the role for idiosyncrasies in explaining the plant-level employment outcome becomes increasingly important in times of contraction.

We find no evidence supporting the hypothesis that large wage compression explains high job reallocation rates. Investigating the covariance structure of job reallocation, we instead find that, beside the net employment growth, the growth in productivity is the single most influential factor.

These findings, we like to believe, are consistent with theoretical models, which stress that the process of growth and technology adoption involves a great deal of experimentation. Accordingly, we find that these reallocative activities have been important in accounting for the long-run growth in productivity.

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1. INTRODUCTION

This paper deals with the heterogeneity of plant-level employment changes in the Swedish manufacturing sector in the 1972-96 period. Ever since the early work of Davis and Haltiwanger (1990,1992), there has been a surge in studies documenting (gross) job flows, using a similar methodology.[1] The broad message from this literature is that no matter what country or what time period studied, large job flows, over and above what is needed to accommodate the net change, is a pervasive phenomenon.[2]

Why we at all should care about this stylized fact should be obvious: If the heterogeneity in the plant-level employment outcome is abstracted from - by assuming representative agents for instance - important features of the dynamic labor market will remain veiled. Alongside the ongoing process of plant turnover and additional employment volatility in the stock of continuing plants, workers are shuffled around between jobs and between job and joblessness. For instance, during 1995 the reallocation of jobs across plants *directly* induced worker reallocation in the range of 16 to 20 percent of the total number of jobs.[3] As the mobility of the work force is limited, some of the expected consequences of job destruction, therefore, include long spells of unemployment, withdrawal from the labor force, together with the associated variations in personal income and the burden placed on the social insurance systems. Bottleneck problems, including retarded growth, are, for the same reason, likely to be associated with the process of job creation.

Two additional findings support this argument: Job flows are highly concentrated to plants experiencing large employment changes; thus, normal worker attrition cannot implement more than a limited fraction of the observed job flows. Also, job flows are highly persistent phenomena; thus, temporary layoff and recall policies cannot be important tools in accommodating the job flows.

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[1] Davis and Haltiwanger are by no means the first authors that paid attention to gross flows of jobs. Early American studies include Leonard (1987) and Dunne, Roberts and Samuelson (1989). The methodology of Davis and Haltiwanger, however, has been widely acknowledged in most of the following studies.
[2] OECD (1994,1996) conducts international comparisons. Davis and Haltiwanger (1999) summarizes the progress of the literature so far with references to international results.
[3] Refers to the fraction of the workforce who in direct response to job reallocation had to change job or labor market status.

Motivated by the consequences for the individual and the macro economic outcome, this study in particular inquires into the sources of the heterogeneity in plant-level employment changes in Swedish manufacturing. The fundamental questions asked are the following: *Why are jobs created and destroyed in excess of what is motivated by the net change* and *why does the reallocation intensity vary over time?*

We acknowledge a quite different institutional setting in Sweden as compared to many other countries, including the U.S. Because of presumably large adjustment costs – resulting from strong unions and strict employment protection laws – we would expect job flows to be lower in Sweden as compared to other, more “flexible”, economies.

An explanation for why job flows still could be substantial in Sweden (and many other European economies) stresses the large wage compression, as pointed out by Bertola and Rogerson (1997). In fact, the reshuffling of jobs rather than wages was one of the explicit aims of the nowadays-abandoned “Swedish Model”. The long time span of data (1972-96) makes is possible to study the effects on job flows of different institutional settings.

The basic findings in this study can be summarized in the following way: Asymmetries across sectors cannot explain why jobs are created and destroyed simultaneously, nor are they able to explain why the intensity of job reallocation varies over time. Instead, most job reallocation takes place within narrowly defined sectors of the economy. A strong finding is that the heterogeneity in the employment outcome across plants increases in times of contraction.

We do not detect any evidence suggesting that the level of wage dispersion affects the level of job reallocation: The rises in the wage dispersion between and within industries have not been associated with decreasing job reallocation neither between the nor within industries.

In comparison to the U.S. results, however, the pace of job reallocation on average has been slower in Swedish manufacturing. A tentative interpretation of this could be made in terms of higher adjustment costs in the Swedish economy, associated with its institutions.

Theoretical models capable of predicting the observed pattern - large scale within-sector job reallocation concentrated to downturns - often stress that growth and technological adoption at the micro level is a complex and heterogeneous process, filled with experimentation and surrounded by uncertain outcomes. Reasons for why the heterogeneous plant-level outcome is especially pronounced in certain periods include that the opportunity cost of experimenting with new technologies and production methods is lower in economic downturn and becomes, for some plants, crucial for survival.[4]

In accordance with the view that growth at the micro level is filled with experimentation with new methods of production, we find that the single most influential factor in explaining job reallocation, besides the phase of the cycle, is the growth in productivity.

We also find a close relationship between the reallocation of jobs and aggregate growth in productivity. In assessing the importance of job reallocation in accounting for the long-run growth, we adopt the same accounting framework as Baily, Hulten and Campbell (1992). We find that a substantial part of the aggregate growth in productivity directly can be attributed to various reallocative activities in each period studied, but the pattern differs in interesting ways between the periods. In particular, the rise in job reallocation in the 1990's was associated with an increased role for input reallocation in explaining the large aggregate growth in productivity.

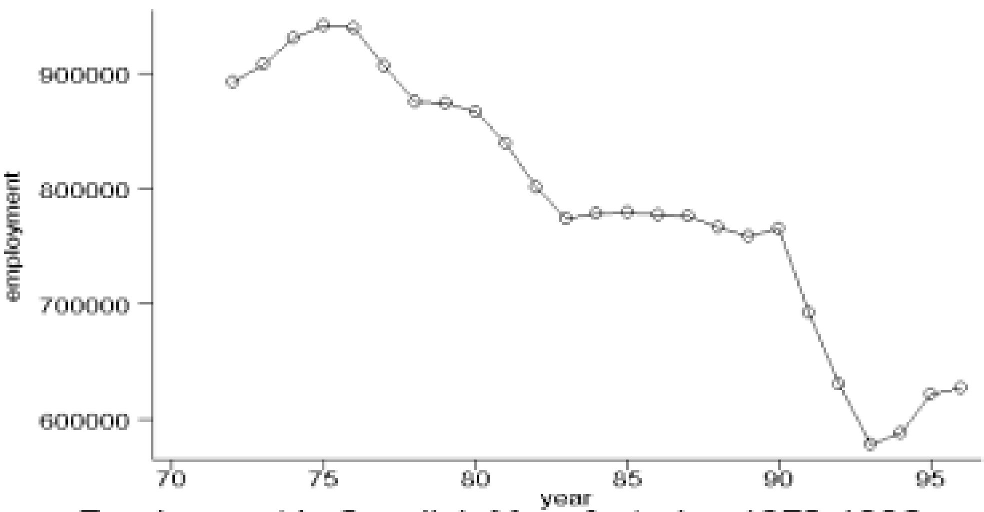
The remainder of the paper is organized as follows: Having presented some background information about the Swedish manufacturing in section 2, data, concepts and measurement issues are discussed in section 3. Section 4 documents the basic facts about the job reallocation process in Swedish manufacturing alongside the dimensions of magnitude, persistence, concentration and cyclical behavior. Section 4 also presents some evidence on how much of the observed worker reallocation that can be attributed to job flows. Section 5 deals with the cross-sectional heterogeneity and the variation in job flows over time. Section 6 presents results on the relationship between job reallocation and the long-run growth in productivity, before, finally, the results are summarized in section 7.

[4] Theoretical models that acknowledge the ongoing within-sector reallocation of in- and outputs, include those which stress selection effects (Jovanovic, 1982; Hopenhayn, 1992; and Ericson and Pakes, 1994) and those which stress the adoption of new technology (Caballero and Hammour, 1995; Mortenson and Pissarides, 1994; and Cooper, Haltiwanger and Power, 1995) as the driving forces of simultaneous job creation and destruction.

2. BACKGROUND: THE NET PICTURE, INSTITUTIONS AND PREVIOUS FINDINGS

Figure 1 (below) shows the annual employment record in Swedish manufacturing over the 1972-96 period according to data from *Manufacturing Statistics*.[5] From 1975, when employment peaked at a little bit more than 940 000 persons employed, there was an ongoing negative trend until sometimes around 1984, when employment was stabilized at around 770 000. The severe crisis in the beginning of the 1990's struck especially hard in the manufacturing industry - this is manifested in the employment record with the three largest negative net changes occurring in three consecutive years between 1990 and 1993. Distributed over the three years, employment fell by more than 185 000 to less than 580 000 in 1993. In the 1993-96 period employment recovered somewhat; the largest positive net change over the period did in fact take place between 1994 and 1995 when employment expanded by some 33 000.

Figure 1



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[5] Data is described under section 2.1. The increase in employment in 1990 is partly an artifact of data, due to changes in the included population in data. (The reported job flow rats in this study are unaffected by these changes).

There are country-specific institutions that might affect job flows that ought to be mentioned in this context: The Swedish Employment Security Act (Lagen om Anställningskydd or LAS), introduced in 1974, provides employees with extensive employment protection. Among other things, LAS stipulates the "first in, first out" principle in case of dismissals caused by redundancy. Furthermore, the probationary period before automatic tenure is a mere six months, which is very short by international standards.

The likely effect of LAS, in particular, and extensive employment protection, in general, is an increased wariness from the employer's side to react on a given disturbance, as the adjustment cost for doing so is high, resulting in less job reallocation.[6]

Also the cyclical properties of job flows could arguably be affected by extensive employment protection, an idea formalized by Garibaldi (1998). According to this model, extensive employment protection will increase the relative variability of job creation to job destruction and, thus, make job reallocation more procyclical.[7]

If high adjustment costs were the only force at work, we then would, ceteris paribus, expect job flows to be relatively modest in Swedish manufacturing as compared to countries with presumably lower cost of adjustment, the U.S. for instance. However, another feature of the Swedish economy is the large wage compression, institutionalized for many years by centralized negotiations. The explicit aim of the "Swedish model" was to accommodate shocks by the reshuffling of jobs rather than by the reshuffling of wages. The underlying idea was to maintain the "solidarity" principle and still achieve economic efficiency through speeding up the restructuring process.

In general, a large compression of wages can be expected to increase job flows – disturbances are accommodated through adjustments in quantities rather than prices – and, thus, counteract the effects on job flows of high adjustment costs.

Around the mid-1980s, the system with centralized negotiations broke down in favor of a system with industry-level negotiations. If the wage structure is important in explaining job flows, we would expect that job reallocation across industries became a less predominant feature.

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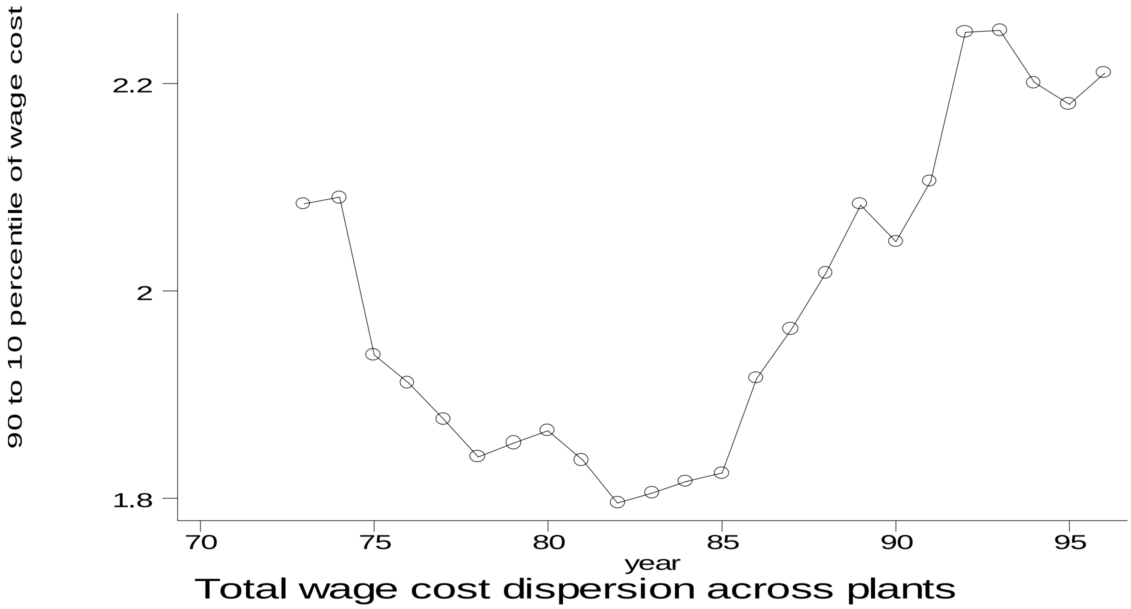
[6] Agell and Lundborg (1993) finds that LAS leads to increased recruitment costs and to a lower propensity to expand employment in an economic upturn. Holmlund (1978) finds that the hiring frequency is lowered as a result of the introduction of LAS.

[7] Boeri (1996) has also emphasized this argument as to why the countercyclical property of job flows mainly is a phenomenon found in the U.S.

Around this time the wage dispersion stopped decreasing and started to increase, as can be seen in Figure 2 (below). In fact the increase in the total wage dispersion since then has been the resulting sum of not only increased wage dispersion between industries but as well the within- industry wage dispersion has increased.[8]

Figure 2



The figure shows the 90:th to the 10:th percentile of wage cost across the plants.

Quite surprisingly, given the presumption of large adjustment costs, but in accordance with the idea of large wage compressions, most European studies on gross job flows document job reallocation rates in the same order of magnitude or even higher than in the U.S. Sweden is by no means an exception: In OECD (1994), the job reallocation rate of nearly 30 percent is, together with the corresponding rate for Morocco, the highest among the countries included.[9]

However, rather than anything else more fundamental, the lesson from this is likely to be that it is hard to undertake international comparisons. Studies differ with respect to concept of the establishment (if it is at all used), the sector of the economy and the time

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[8] The increasing wage dispersion is confirmed by the results in Hibbs and Locking (1996). Using individual data, they also find that the increasing wage dispersion within plants as well.
[9] In section 3 the formal definitions of the various flow statistics are given. A job reallocation rate of 30 percent states that three out of every 10 jobs either are created or destroyed during the course of a year.

period covered, restrictions to the included population and so on. For instance, as pointed out by Persson (1998), the reported job flows for the Swedish economy in the OECD study suffers form the inability to correctly follow the establishments longitudinally.[10]

Nevertheless, throughout this paper references will be made to U.S. results, as reported by Davis and Haltiwanger (1992,1996,1999) using the *Longitudinal Research Database* (or LRD). This is conducted with the argument that LRD and the *Manufacturing Statistics* – the data used in this study – share many important features and, thus, the scope of comparability should not be overwhelmingly bad.

3. DATA, CONCEPTS AND MEASUREMENT ISSUES

3.1 Data

Annual, plant-level data over the 1972-96 period are available from *Manufacturing Statistics* (Industristatistiken or IS) produced by Statistics Sweden. IS covers almost the universe of employment in the manufacturing sector (Major Division 10-37, Mining & Quarrying and Manufacturing) over the period; the included population is somewhat limited with respect to the smallest establishments. Altogether, the sample adds up to roughly 251 000 annual observations on 25 000 different establishments.

Each establishment is classified according to detailed industry, region and ownership. Apart from employment data, data at the plant level include information on sales, value-added, wages and other costs.

In constructing flow measures, the ability to accurately trace the establishments longitudinally is crucial - the inability to do so will result in job flow estimates that are generally biased upward. Apart from the coverage, another two features of our data enhance the quality: First, the nature of the establishment concept used in IS reduces the risk of false flows. The establishment is defined only in terms of its production and

[10] In the *Regional Employment Statistics* (Årsys), used by OECD (1994) and Persson (1998), the establishment can change identity as a consequence of changes in the ownership, for instance. Persson uses a demographic method to control for spurious flows.

physical location, which, for instance, implies that legal changes of ownership would leave the identities of the establishments intact.

Second, IS has been linked to *the Central Firm and Establishment Registry* (Centrala företags- och arbetsställeregistret). Data quality has been found to be especially sensitive to the notion of entry and exit of establishments and, for example, the fundamental difference between plant closures and plants missing in data has not always easily been accounted for. However, the linkage to another source of data has provided us with the explicit information on the timing of the start-up and on the possible timing of the closure of the establishment.

Together with LRD, IS shares the features of being intended for the longitudinal tracking of establishments, using a similar establishment concept, in the manufacturing sector over a long period. Unfortunately it shares another feature with LRD, namely that the sample is not random with respect to smallest of plants.[11] Because smaller establishments tend to be more volatile with respect to employment, the reported job flows measures are, therefore, somewhat biased downward. However, the effect from this is small.[12]

Nevertheless, the comparability to the results of Davis and Haltiwanger should be good, since IS shares many of the virtues as well as some problems with the LRD.

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[11] The sample in IS is not random with respect to plants with fewer than 10 employees. Unfortunately sample weights are not available. Apart from this limitation, the universe of plants is included. See publications from Statistics Sweden (in Swedish) for a complete description of the sampling procedure in IS. In comparison, the LRD does not contain plants with fewer than 5 employees and sample plants with fewer than 250 employees with known sample weights. See Davis, Haltiwanger and Schuh (1996) for a description of the LRD.

[12] The reported job reallocation here underestimates the true job reallocation with approximately 6 percent (or 0.7 percentage points at the average job reallocation). This, of course, is the sum of even smaller bias in job creation and destruction, respectively. In the bias calculation we have considered the following facts: (1) According to IS, at most 8 percent of the employment is concentrated in the non-included plants, which is an upper bound on the their *average share of employment* during a year. (2) The job reallocation rate among the non-included plants is about 1.8 times higher than in the sample average. This figure is obtained from the results on the smaller plants that are included. This figure is not contradicted by earlier Swedish results. Combining these two considerations gives the result.

3.2 Measuring gross job flows[13]

Gross job flows are measured in terms of employment deviations from the previous period at the plant level. Denote the level of employment at the establishment in period t with n_{et} and let Δn_{et} denote the deviation in employment between period t and t - 1, i.e. $\Delta n_{et} = n_{et} - n_{et-1}$. Furthermore, let the set of establishments in sector S (where S refers to the whole manufacturing sector or parts of it) with $\Delta n_{et} > 0$ be denoted S^+ and let the set of establishments in sector S with $\Delta n_{et} < 0$ be denoted S^-.

(Gross) job creation in sector S in t, C_{st}, is calculated as the sum of all employment deviations in S^+. Correspondingly, *(gross) job destruction*, D_{st}, is calculated as the absolute sum of all employment deviations in S^-. To express these measures as rates, we divide by the size of the sector. Given our data, the best approximation of the plant size during period t is the average employment in period $t - 1$ and t, i.e. $x_{et} = 0.5(n_{et} + n_{et-1})$. Accordingly, X_{st} denotes the size of sector S in period t, i.e. $X_{st} = \sum_{e \in S} x_{et}$.

The job flow rates can also be expressed as size-weighted sums over the plants' growth rates. That is,

$$c_{st} = \frac{C_{st}}{X_{st}} = \sum_{e \in S_t^+} g_{et} \frac{x_{et}}{X_{st}}$$

and $$d_{st} = \frac{D_{st}}{X_{st}} = \sum_{e \in S_t^-} |g_{et}| \frac{x_{et}}{X_{st}},$$

where $$g_{et} = \frac{\Delta n_{et}}{x_{et}}.$$

The growth rate is symmetric around zero and bounded in the [-2,2] interval, where the boundaries represent the growth rate of an entering plant and an exiting plant respectively.[14]

[13] The conventions of Davis and Haltiwanger (e.g. 1990,1992) are followed in defining the various job flow statistics. Therefore, those readers already familiar with the job flow concepts and who are aware of the usual caveats about what is measured and not might directly proceed to the next section.

[14] Note that the entry and exit of plants can be treated as symmetrical events as a consequence of the size measure used.

The sum of job creation and destruction is the *job reallocation, R,* which measures the total number of employment positions (or jobs) reallocated. The difference between job creation and destruction is, of course, the *net employment change, NET.*

Job reallocation over and above what is needed to accommodate the aggregate net change in employment, *the excess job reallocation, ER,* is calculated as R – abs(NET) and is our measure of overall heterogeneity in the plant-level outcome of employment changes.[15] The excess job reallocation is bounded in the [0,R] interval, where the lower bound is reached if all establishments change the employment in the same direction; i.e. all job reallocation is then necessary to accommodate the aggregate net change in employment.

To relate job flows to worker reallocation, we note that the job reallocation represents an upper bound for the number of workers who in *direct* response to job flows have to change jobs or switch between employment and non-employment. It is an upper bound because some workers may be counted twice, as they who move from a shrinking to a growing establishment within the period. The minimum number of workers who in direct response to job flows have to change jobs or switch between employment and non-employment is equal to the maximum of job creation and destruction. Therefore, the worker reallocation induced by job reallocation, *IWR,* is bounded in the closed interval of max[C,D] and R.[16]

According to the previous convention used for job creation and destruction, lowercase letters will denote the corresponding rates for *R, NET, ER* and *IWR*.

3.3 Measurement issues

Before the basic job flow statistics are presented, a few words should be mentioned about what is measured and what is not.

We interpret employment changes at the establishment as changes in the desired number of employment positions or jobs. Yet, it is possible that some of the observed

[15] Note that job reallocation does not serve as a good measure of heterogeneity since it is increasing in absolute employment changes.

[16] We refer to the upper and lower bound of IWR as IWR_{min} and IWR_{max}, but of course IWR_{max} always equals R.

changes in employment are in fact due to temporary changes in the number of unfilled positions.[17]

Another shortcoming is that we do not discriminate between differences in contracts, e. g. a full-time job and a part-time job do equally count as one.[18]

Estimated job flows are for two reasons also minimum estimates of true job flows.[19] First, a job is simply defined as a filled employment position and, thus, no distinction is made between different kinds of positions, e.g. with respect to the requirements. Substitution between different kinds of jobs within the establishment will, therefore, not fully be accounted for in our job reallocation measure.

Second, the timing of data collection makes it impossible to detect job flows that are reversed within the sampling period.

Bearing these caveats in mind, we now turn to present the basic job flow statistics in Swedish manufacturing.

4. JOB FLOWS IN SWEDISH MANUFACTURING

As full of drama as it is, the net employment record shown in Figure 1 (above) captures the dynamics of the labor market in a rather limited sense. The observed net changes in employment have been the sum of large gross flows of jobs at the plant level. During the average year, more than 90 000 jobs are created and destroyed; a number that by large exceeds what would have been needed to accommodate the net change in employment; neither the number of new jobs nor the number of lost jobs has fallen short of 20 000 in any year during the period.

Using the analytical tools developed in the preceding section, basic facts about the job reallocation process in Swedish manufacturing will be laid out in this section. The section starts out with the magnitude and cyclical behavior of job flows.

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[17] The hypothesis that job flows mainly should reflect variations in the number of unfilled positions is consistent with low persistence rates in the observed job flows, an issue that will be addressed later on in section 4.

[18] Another difference in contracts is the one between temporary and permanent jobs, which has been studied in Arai and Heyman (1999).

[19] This also implies that worker reallocation induced by job flows is subject to the lower bound nature of job flows.

4.1 Magnitude and cyclical behavior

Table 1 (below) summarizes the annual job flow statistics in the Swedish manufacturing sector. A number of interesting facts emerge: (1) There have been non-negligible job flows during every year, but (2) as compared to results on U.S. manufacturing, the average pace of job reallocation has been slower. (3) There has been a substantial variation over time in the gross job flows; masked by the low averages are periods of large-scale job reallocation, and (4) job reallocation exhibits a counter-cyclical pattern.

Table 1

Gross annual job flows in Swedish Manufacturing, 1972-96.

Statistic	Mean	(Std. dev.)	Min	Max	U.S.
c	5.1	(1.6)	2.7	9.3	9.1
d	6.8	(3.1)	3.9	15.8	10.3
r	11.8	(3.3)	8.9	20.4	19.4
net	-1.7	(3.8)	-11.2	5.0	-1.1
er	9.0	(2.1)	5.3	14.9	15.4
iwr_{min}	7.3	(2.9)	4.6	15.8	11.7
iwr_{max}	11.8	(3.3)	8.9	20.4	19.4
Pearson correlations (Marginal significance level)					
$\rho(c_t,d_t)$ = - 0.17 (0.42)			$\rho(net_t,r_t)$ = -0.60 (0.00)		

The last column refers to the results on the U.S. manufacturing industry over the 1972-1988 period, as reported by Davis, Haltiwanger and Schuh (1996, table 2:1).

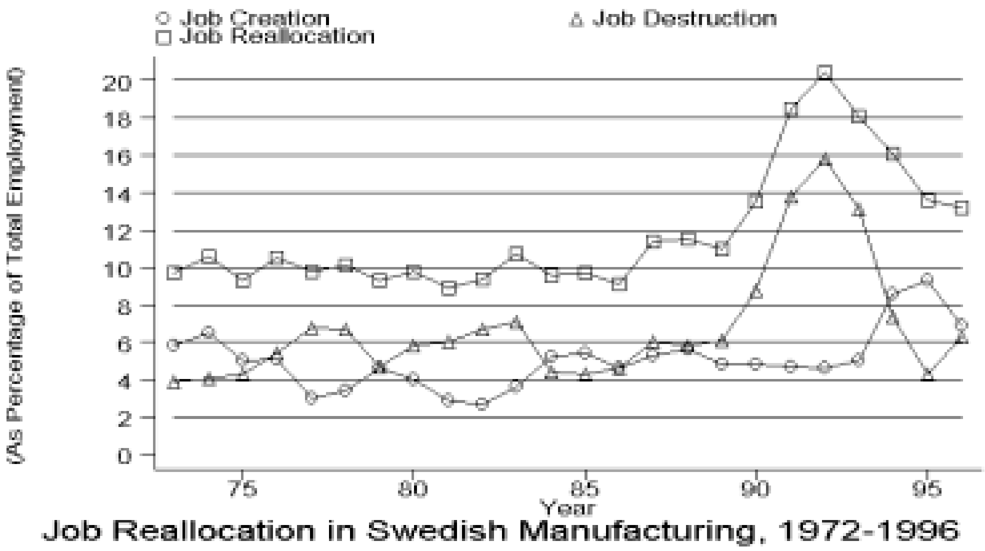
The average job reallocation rate of 11.8 percent tells us that during the course of the typical year a little more than one in every ten jobs are either created or destroyed. This is the sum of 5.1 percent of the jobs being created and 6.8 percent of the jobs being destroyed; the larger job destruction has resulted in the negative growth rate in net employment of 1.7 percent annually.

The heterogeneity in the plant-level employment outcome is verified by the average excess job reallocation rate of 9.0 percent. Most of the observed job reallocation, thus, has been over and above what has been necessary to accommodate the net employment changes in the manufacturing sector. For instance: During 1995, when manufacturing employment expanded by 5 percent, gross job destruction was still 4.3 percent. During 1992, when manufacturing employment shrank by 11.2 percent, gross job creation was still 4.6 percent.

Looking at the reported correlations, we note - in contrast to the conventional view of business cycles - that the correlation between job creation and destruction is being far from perfectly negatively correlated. Job reallocation is significantly counter-cyclical over the period, which is the result of a higher variability in job destruction than in job creation. That the heterogeneity of the plant-level employment outcome increases in times of contraction is a result that has been found also in U.S. studies (Davis and Haltiwanger, 1992), although the generality of this result has been questioned (Boeri, 1996).

The fifth column reports job flow statistics on the U.S. manufacturing sector over the 1972-88 period, as reported by Davis, Haltiwanger and Schuh (1996). The differences in the job reallocation numbers between Swedish and American manufacturing can roughly be stated as: For every job reallocated in the Swedish manufacturing sector, nearly two jobs are reallocated in the U.S. manufacturing sector, and the heterogeneity, as measured by excess job reallocation, is about 1.5 times larger in the U.S.

Figure 2



The perception of job flows being relatively modest in Swedish manufacturing is partly due to the inability of the averages in Table 1 to reveal a changing world. A striking aspect of the job flow statistics is a “shift” in the job reallocation process, initiated in the late 1980’s. In Figure 2 (above) the evolution of job creation, job destruction and job reallocation is shown year-by-year.

Having oscillated in the 9-11 percent neighborhood in the preceding period, the job reallocation rate started to increase sometimes around 1987 to peak in 1992 at a 20.4 percent level; during 1992 more than one in every five jobs were either created or destroyed. The increase in the job reallocation rate reveals that the dramatic fall in manufacturing employment in the early 1990's was mainly accommodated by an increase in the number of jobs destroyed, rather than by a decrease in the number of jobs created. In fact, there was no marked decrease in job creation at all, and the job creation rate has never been as high as when employment started to recover somewhat during the last three years.

The low *average* pace of job reallocation in Swedish Manufacturing could be interpreted in terms of presumably higher adjustment costs in Sweden as compared to the U.S.

However, the increase in job flows is hard to interpret in terms of any changes in the institutional settings. Notably, a reduced wage compression, as a result of the abandonment of the "Swedish model" that took place sometimes around the mid-80's, would, ceteris paribus, according to the theoretical model of Bertola and Rogerson (1997) result in lower rates of job reallocation. Clearly, any such effects are not detectable in the job reallocation pattern in Figure 2.

Instead, a likely explanation to the rise in the job reallocation probably includes an unusually high intensity of restructuring in the manufacturing during the 1990s. Because of a presumably faster pace in the process of technological change, the reallocation of in- and outputs has become increasingly important. A look at how the aggregate growth in productivity came about during this period (section 6) will provide further evidence in favor of this view.

Furthermore, the countercyclical movement in job flows is not in accordance with the idea that extensive employment protection will result in a higher relative variability in job creation as compared to the variability in job destruction (Garibaldi, 1998; Boeri, 1996).

The two basic findings we bear in mind from this section are that there is tremendous heterogeneity in the plant-level employment outcome and that the scope of the heterogeneity has varied considerably over time; in particular, job reallocation is countercyclical. These issues are addressed in section 5.

Before that, however, we proceed with the issue of how the economy can be expected to implement the observed job flows. If the observed job flows are small in comparison to the mobility in the work force, concentrated to plants experiencing small employment changes and not of a very persistent nature, the implementation can be expected to be smooth; normal worker attrition and temporary layoff and recall policies is then likely to accommodate a large fraction of the job flows.

However, if the situation is the other way around, it is the likely case that observed job flows are closely associated with phenomena like unemployment, withdrawal from the labor force and bottleneck problems.

To evaluate the likely consequences of job flows, we in turn treat the issues of job and worker flows, concentration of job flows, and the persistence of job flows.

4.2 The connection to total worker reallocation

According to the last two rows of Table 1, job flows have, on average, directly induced worker reallocation in the range of 7.3 to 11.8 percent.[20] It is important to recognize that this range only measures the worker reallocation needed in *direct* response to job flows. Secondary waves of worker reallocation in response to job flows are not accounted for, but is the likely result as vacancies are opened when a worker leaves his current position for a newly created job.

Total worker reallocation is induced by establishment heterogeneity, i.e. job flows; by match heterogeneity in excess of establishment heterogeneity, often referred to as churning flows; and by life-cycle motives, e.g. inflow into the labor force from the educational system and outflow from the labor force because of retirements. If the latter two components are large relative to the former, it is likely that a large fraction of the observed job flows can be accommodated by worker flows that would have taken place anyway.

In order to evaluate the importance of job flows in explaining worker flows, we compare the worker reallocation induced by job flows with the total numbers of persons who switch jobs or employment status. IS does not contain information on individuals, therefore the total number of persons who switch jobs or employment status has been

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[20] Remember that the upper bound of this range is subject to the lower bound nature of job flows as discussed under section 2.3 and also to the non-randomness of data with respect to the smallest plants.

calculated using data from *the Regional Statistics on Employment* (Årsys) over the 1985-96 period.[21] The population is limited to individuals working in the same establishments as covered by IS.

Our measure of worker reallocation, *wr*, has been calculated as the number of individuals who in period *t* has changed employment position or changed between job and joblessness since the preceding period *t* - 1. This is expressed as a rate by dividing with the average employment in the two periods.

According to the calculations presented in Table 2 (below), 36.7 percent of the manufacturing workforce has changed employment positions or changed between job and joblessness during the average twelve-month interval in the 1985-96 period. Comparing this figure to the number of individuals who in direct response to job flows have to change between jobs or between jobs and joblessness, we find that between 26 and 41 percent of the observed worker reallocation has been necessary to account for establishment heterogeneity.[22] This fraction has increased over time, as a consequence of both larger flows of jobs and less worker reallocation in excess of what is needed to accommodate the job flows.

Although total worker reallocation is bounded to be at least as large as worker reallocation induced by job flows, there is a negative correlation between job and worker reallocation, because churning flows are procyclical. The implied countercyclical movement in the fraction of worker reallocation directly induced by worker flows could be interpreted in terms of workers being less inclined to participate in “job shopping” during recessions.

[21] Årsys is not available prior to 1985.

[22] Davis and Haltiwanger (1992,1996) report a corresponding fraction of total worker reallocation induced by job flows in the range of 36-53 percent. Since both calculations involve a number of weaknesses, I refrain from making any comparisons based on this finding.

Table 2

Worker and Job Reallocation.

Year	wr	r	iwr_{min}/wr	iwr_{max}/wr
1986	40.5	9.1	0.11	0.22
1987	41.0	11.4	0.15	0.28
1988	42.9	11.5	0.14	0.27
1989	42.9	11.0	0.14	0.26
1990	46.6	13.5	0.19	0.29
1991	34.2	18.5	0.40	0.54
1992	34.6	20.4	0.46	0.59
1993	32.9	18.1	0.40	0.55
1994	31.8	16.1	0.27	0.51
1995	30.2	13.6	0.31	0.45
1996	26.5	13.2	0.26	0.50
Mean	**36.7**	**14.2**	**0.26**	**0.41**
Pearson correlation (marginal significance level)				
$\rho((iwr_t/wr_t),net_t) = -0.56$ (0.07)				

iwr_{min}/wr is the minimum fraction of total worker reallocation directly induced by job flows. iwr_{max}/wr is the maximum fraction of total worker reallocation directly induced by job flows.

The reported correlation refers to the average of minimum and maximum fraction of induced over total worker reallocation, i.e. $iwr_t/wr_t = 0.5*((iwr_{min,t} + iwr_{max,t})/wr_t)$.

Even though the measure of worker reallocation in principle is comparable to the measure of job reallocation based on IS, there are a number of weaknesses with the individual data, which probably cause a substantial upward bias in the worker reallocation estimates. Therefore, these numbers should be treated with a great deal of caution.[23] The causes for an upward bias include the poor ability to follow the establishments longitudinally and the sampling scheme.[24]

Though, admittedly, there are weaknesses in the calculations of worker reallocation, and because of the resulting upward bias, it seems safe to conclude that much of the observed worker reallocation is the result of demand factors rather than anything else; in the sense of being induced by shifts in the employment distribution across plants. It also seems like job flows become increasingly important in recessions in explaining worker reallocation.

[23] In comparison to the worker flow rate (hires + accessions) reported by Persson (1998), the worker reallocation is in the same order of magnitude. But while the worker flow rate might count some individual twice, the worker reallocation rate measure used here does not.
[24] The sample from Årsys are those establishments covered by IS. This was done in order to get a linked employer/employee data set. However, the linkage possibility between the two has, as of today, proven to be quite poor.

4.3 Concentration

The preceding results established that a large fraction of the observed worker reallocation is due to shifts in the distribution of employment positions across plants. This observation alone does not provide enough information for an evaluation of the likely economic outcome resulting from the reshuffling of jobs.

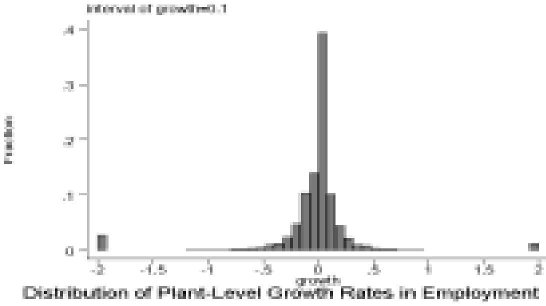
Given a limited mobility of the worker, it makes a great difference if the observed job flows are the result of many plants changing the employment relatively little or if job flows are the resulting sum of relatively few plants changing employment a lot. Under the former regime, normal worker attrition can probably accommodate a large fraction of the job flows. Under the latter regime, one would instead expect job destruction to be closely related to the inflow into unemployment and to the outflow from the labor force; and job creation to be closely related to bottleneck problems.

Figure 3 and Figure 4, respectively, plots the non-weighted and employment-weighted distribution of all annual plant-level growth rates over the 1973-96. The first thing we learn from the distributions is that in the normal situation there is no change at all in plant employment. The distribution of growth rates is highly concentrated around zero growth with small endpoint spikes corresponding to births and deaths. On an unweighted basis (Figure 3), 40 per cent of the annual growth rates are concentrated in the (-0.05,0.05) interval and 71 per cent in the (-0,15,0.15) interval. In fact, 25 percent of the observations had a growth rate of exactly zero. We also note that the role for a changing pool of establishments is limited, as very little mass is concentrated at the endpoints.

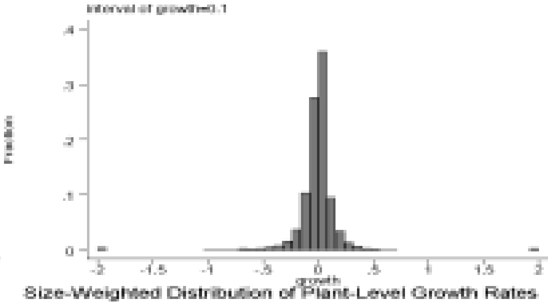
In comparison, the employment-weighted distribution (Figure 4) has even less mass concentrated in the tails, suggesting that both establishment turnover and employment volatility are decreasing functions of size. On an employment-weighted basis, 46 and 82 per cent are concentrated in the (-0.05,0.05) and in the (-0,15,0.15) interval, respectively.[25]

[25] In comparison to the growth distribution in the U.S. manufacturing, as presented by Davis and Haltiwanger (1992), the distribution of growth rates in Swedish manufacturing seems to more highly concentrated around zero with less mass concentrated to establishment turnover. They report that the corresponding concentration of the unweighted growth rates in the (-0.05,0.05) interval is 25 percent and roughly 15 percent of the growth rates are concentrated to births and deaths.

Figure 3 and Figure 4



Distribution of Plant-Level Growth Rates in Employment



Size-Weighted Distribution of Plant-Level Growth Rates

Turning instead our attention to the concentration of job flows, Table 3 (below) summarizes the average annual distributions of job creation and destruction by growth rate intervals. By concentration we simply mean how job creation and destruction are distributed by establishment growth rates. Issues of special interest include: Is job reallocation mainly the result of a changing pool of establishments or does most job reallocation take place in the continuing plants?

In spite of the earlier findings on the distribution of growth rates, we note that a substantial part of job creation and destruction is the result of rather large annual changes in plant-level employment. Around 60 percent of all job destruction during the period has taken place in plants shrinking by more than 20 percent during the course of a year and some 50 percent of job creation has taken place in plants growing with more than 20 percent during the course of a year.[26]

In particular, the average annual contribution from entry and exit over the 1972-96 period was 16 percent of job creation and 14 percent of job destruction respectively. However, the true importance of entering and exiting plants in the employment dynamics is undermined by the fact that the entry and exit process probably should not be regarded as instantaneous. That is, only because plants tend to be born and die small, en-

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The fact that the sample used here is not at random with respect to the smaller establishments and because of more volatility in smaller plants, the distributions exaggerate the impression of a high concentration around zero growth, especially what regards the non-weighted distribution.

[26] Note that this refers to the growth rate as defined in section 2.2. One should keep in mind that any given value of the growth rate here translates to a higher value of the conventional growth rate. The two growth rates are related to each other in the following way, where *g* denotes the growth rate used here and *G* denotes the conventional growth rate: $G = 2g/(2-g)$. For instance g = 1 corresponds to G=2 and g = - 1 corresponds to G = -0.66.

try and exit are not necessarily unimportant features in the evolution of employment. For instance, using a sampling interval of five years instead, the role for entry and exit increases substantially; some 30 percent of all job reallocation in the longer run can be attributed to plant turnover.

The results from Table 3 together with the results on the growth distribution suggest a considerable lumpiness in plant-level employment changes; employment changes in the plant are infrequent, but large when they occur. Even so, job creation and destruction have on average been much more concentrated to smaller growth as compared to corresponding U.S. results.[27]

Table 3

Concentration of Job creation and destruction.

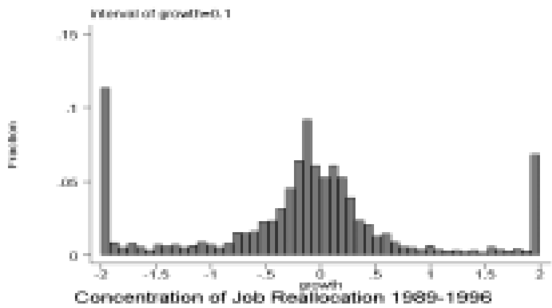
Percentage of job creation and destruction accounted for by plants with growth rates in the indicated interval. (Annual averages)

	Job destruction			Job creation		
Period	[-2,-1)	[-1,-0.2)	[-0.2,0)	(0,0.2]	(0.2,1]	(1,2]
1972-96	24.7	35.4	39.9	48.3	31.9	19.8
1972-88	19.7	34.7	45.6	56.7	27.3	16.0
1989-96	31.8	36.5	31.6	33.5	40.1	26.4

Table 3 also divides the data into the two sub-samples corresponding to the 1972-88 period and to the 1988-96 period. The shift in the reallocation process is once again demonstrated. Not only did the magnitude of job reallocation increase; job reallocation also became much more concentrated to plants with larger employment adjustments in the latter period. The change in concentration is perhaps best visualized in Figure 5 and Figure 6.

[27] Davis et al (1996) reports that 75 percent of job destruction and 70 percent of job creation are concentrated to plants with an absolute growth rate larger than 0.2.

Figure 5 and Figure 6



Whereas almost 70 percent of the mass in the distribution of job reallocation was concentrated to the (-0.5,0.5) interval in the former period, almost 70 percent of all job reallocation took place in plants growing or shirking by more than 20 percent in the latter period. Also there has been an increased role for establishment turnover, as verified by the somewhat larger spikes corresponding to entry and exit.

Needless to say, the results on concentration indicate that normal worker attrition can only account for a limited fraction of the observed job flows. Furthermore, the apparent shift detected also in how job flows are concentrated indicates that the importance of a flexible work force has increased over time.

3.6 Persistence

Job reallocation may not be a very persistent phenomenon as a consequence of job flows merely representing changes in the stock of unfilled vacancies, rather than changes in the stock of employment positions, and/or as a consequence of the use of temporary recall and layoff policies.

Table 4 (below), however, tells us that job flows, and in particular job destruction, are persistent phenomena: 86 percent of the newly destroyed jobs are still not reopened within a year and 74 percent of the newly created jobs are not destroyed within a year. This strongly suggests that most job flows cannot be implemented by temporary layoff and recall policies.

These figures are somewhat higher than the corresponding figures for the U.S.[28] The difference could possibly be interpreted in terms of higher adjustment costs in the

[28] Davis, Haltiwanger and Schuh (1996) reports one- and two-year persistence rates of 70.2 and 54.4 rates for job creation and 82.3 and 73.6 for job destruction, respectively.

Swedish economy and in terms of temporary contracts being a more important phenomenon in the U.S.

Table 4

Persistence in Job Creation and Job Destruction.

Persistence Rates for job Flows 1972-1996. (Annual Averages)					
	Horizon (in years)				
Persistence rate	1	2	3	4	5
job creation	0.74	0.61	0.53	0.46	0.41
job destruction	0.86	0.80	0.76	0.73	0.71
Pearson correlations (marginal significance level)					
$\rho(pc_t^1, net_t) = 0.67$ (0.00)			$\rho(pd_t^1, net_t) = -0.57$ (0.00)		

The *N-year persistence rate* in job creation (destruction) is defined as the fraction of newly created (destroyed) jobs in period *t* that are not destroyed (reopened) in every consecutive period until period *t* + *N*.

The reported correlations are between the one-year persistence rates in job creation, pc^1, and job destruction, pd^1, on the one hand, and the net employment change, on the other hand.

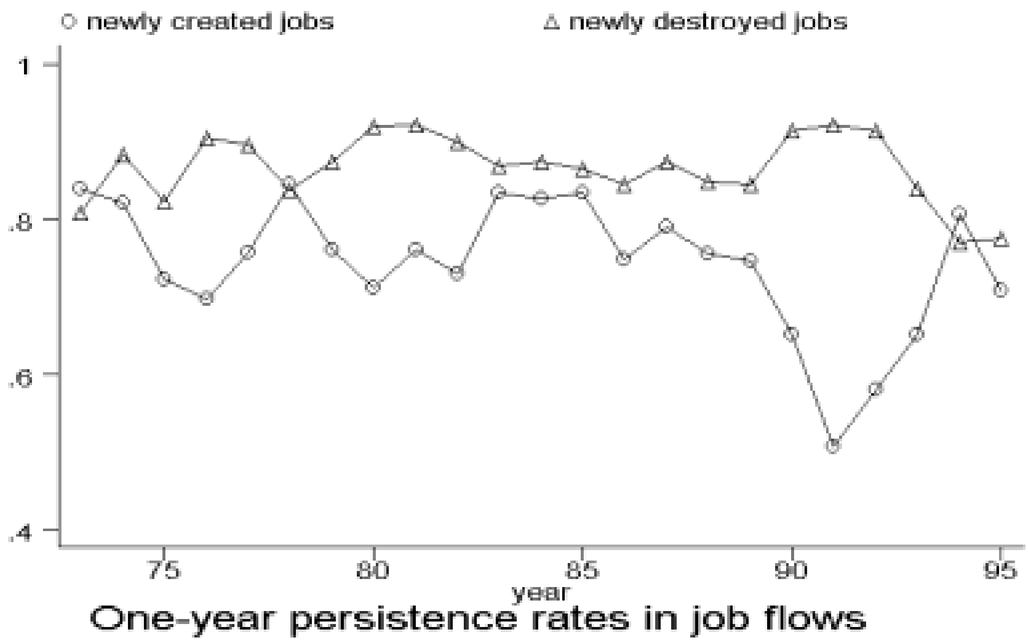
The large discrepancy between the persistence rates of job creation and destruction indicates that the process of downsizing is a more gradual process than the process of job creation is, although the negative trend in employment also contributes to explain the fact (see Figure 7). One explanation for why the process of job destruction would be a more gradual process than job creation is, is the use of quits as a cheaper way to implement decreases in employment than the usage of layoffs is in the presence of firing costs.

In Figure 7 (below) the evolution of the one-year persistence rates are depicted. Although there was no marked fall in job creation during the crisis in the beginning of the 1990's (see Figure 2), it is apparent from Figure 8 that the persistence in job creation fell rather dramatically; job destruction was permanent at the same time as job creation was temporary. In the context of Swedish job protection laws, this of course further augmented the implications for the concerned individual of the increased job destruction during the early 90's.[29]

[29] As mentioned in the background section, LAS stipulates the principle of "last-in-first-out". This implies that the individual holding the newly created job normally would be the same individual concerned if the flow would be reversed. However, the connection is less clear given that the law is optional and can be circumvented through negotiations between the union and the employer.

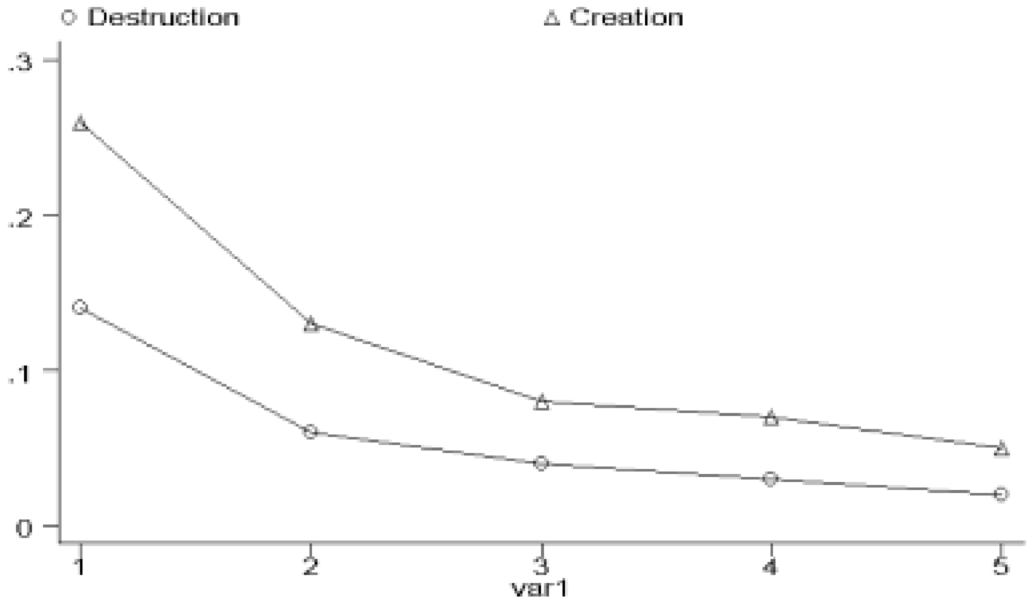
We note that the persistence in job destruction moves countercyclically and the persistence in job creation moves procyclically. A job created in a recession is less likely to survive than a job created in an expansion. At the same time, a job destroyed in a recession is less likely to end in a recall. These are interesting facts as they could contribute to explain the high autocorrelation in unemployment, given the presumably close connection between job destruction and unemployment.

Figure 7



Though we find job flows to be persistent phenomena, the persistence in a newly created job is considerable lower than the persistence of the average job in the stock. The average job destruction rate in Table 1 of 6.8 percent translates to a persistence rate of 0.93 for the average job in the stock. In Figure 8 (below) the conditional probability of reversal of the newly created and destroyed job are plotted. Not until after approximately 5 years is the hazard rate about the same for a newly created job and the average job in the stock.

Figure 8



Conditional probability of reversal of job flows

In summary: A large fraction of the observed worker reallocation is demand driven, in the sense of being induced by shifts in the employment distribution across plants rather than anything else. This finding - together with the facts that job flows are not to be implemented neither by normal worker attrition nor by temporary layoff and recall policies - makes the case for why we ought to treat the heterogeneity surrounding the employment outcome across plants seriously.

5. THE HETEROGENEITY IN JOB FLOWS

In the preceding section the basic facts about the job reallocation process in Swedish manufacturing were established. Two major findings stand out: (1) During every year, large gross flows of jobs, over and above what is needed to accommodate the net change in employment, is a pronounced feature, and (2) the job reallocation rate varies considerably over time. We argued in the preceding section that the implementation of the job flows in the economy cannot be smooth, but instead is associated with phenomena such as unemployment and bottleneck problems.

Motivated by the likely consequences for the individuals affected and by the likely bearing on the macro economic outcome, we will in this section systematically try to explain the heterogeneity in the process of job reallocation. In particular the quest is to find answers to the following two fundamental questions: (1) *What explains simultaneous job creation and destruction*, and (2) *why does the rate of job reallocation vary over time?*

Reasons for why jobs are created and destroyed simultaneously are clearly not to be found in the traditional framework of representative agents. However, the notion of heterogeneity is admittedly dependent on the level of abstraction. An immediate objection against interpreting simultaneous job creation and job destruction as heterogeneity is, therefore, that we so far have not ruled out the possibility that the seemingly heterogeneous behavior is caused by asymmetries across sectors. That is, one possible explanation for the high rates of excess job reallocation might very well be that jobs are created in certain sectors of the economy while destroyed in others.

Differences in the employment outcome across industries might arise for a number of reasons, including differences in the product demand conditions and the utilization of different mixes of inputs. Regional differences, apart from reflecting different industrial mixes, could arise as a consequence of regional differences in the cost of labor, transportation, energy etc.

Also for within-sector heterogeneity there are theoretical explanations. In the literature that involves selection effects (Jovanovic, 1982; Ericson and Pakes, 1989; and Hopenhayn, 1992), plants face ex ante uncertainty about their true efficiency. Plants that accumulate favorable information about their efficiency expand and survive, whereas the less favored plants exit the market. Given that age and size can serve as proxies for the plants' stage in the process of initial learning, this literature implies that job flows would be a decreasing function of these characteristics.

Although the human capital literature, by itself, cannot explain the simultaneous occurrence of job creation and destruction, it adds to our understanding, in the sense that it has implications for the magnitudes of job flows. As pointed out already by Oi (1962), a high degree of firm-specific capital would result in a more permanent relationship between the individual and the plant. The wage is likely to be correlated with the amount of firm-specific capital in labor and, thus, job creation and destruction are expected to be decreasing in wages.

The vintage capital literature provides another rationale for why jobs are created and destroyed simultaneously. Sunk costs associated with the installation of new capital in association with technological progress or idiosyncratic chocks give rise to job flows in excess of the net employment change. In the model of Caballero and Hammour (1995) new technology can only be adopted by the entry of new establishments and, thus, the only sources of job reallocation is through entry and exit. Instead, in the model of Cooper, Haltiwanger and Power (1997) existing plants adopt new technology by retooling. The retooling process may generate within-plant and between-plant job reallocation depending on the nature of the new technology.

These models, including the model of Mortenson and Pissarides (1994), also have implications for the timing of the reallocation process. Aggregate disturbances, in product demand for instance, will in such models generally give rise to a countercyclical movement in job flows. Differences in the level of productivity across the plants imply that plants will react quite differently to an adverse shock. Possibly a large fraction of the low-productive plants will be pushed over an adjustment threshold, and as a consequence they are forced to react by either updating their current unfavorable technology to a new one or exit. Thus, such a process could account for our finding that job reallocation seems to be countercyclical.

However, a competing hypothesis is that there are systematic differences across sectors in the responses to aggregate disturbances, which is an important element in the traditional view of the business cycle (Abraham and Katz, 1986).

5.1 Why are jobs created and destroyed simultaneously?

Needless to say, it is beyond the scope of this paper to evaluate each of these theoretical strands of literature. But the preceding remarks at least identify some of the factors that are expected to affect the job flow pattern.

This section starts out by presenting evidence on how job flows vary by characteristics of the plants. Tables 5 through 7 (below) present the job flows statistics by 18 industries, by 24 regions and by other plant characteristics.

When dividing the manufacturing into industries (Table 5) and into regions (Table 6), the message is that the job flow pattern in each and every industry and region, with few exceptions, resembles the aggregate picture presented in Table 1.[30] Average, annual job reallocation rates range between 7.4 and 14.6 percent in the industries and between 9.7 and 13.8 percent in the regions.

If the simultaneous occurrence of job creation and job destruction mainly would be the resulting sum of asymmetries across sectors, we would expect the within-sector excess job reallocation to be a less predominant feature. Clearly, the average job reallocation rates in the different industries and regions are not the resulting sums of jobs being created in certain periods and jobs destroyed in other periods, which is verified by high excess job reallocation rates. Thus, the observed heterogeneous employment outcome across plants is not mainly an artifact of industry or regional effects.

In spite of this, the division of manufacturing into industries potentially explains some of the observed heterogeneity in job flows at the manufacturing level. The variation in net employment changes across industries is quite large; the industries creating the jobs are not necessarily the same ones that destroy jobs, which is reflected in the weak cross-industry correlation between job creation and destruction. The same holds true, but to a much smaller extent, with respect to regions. All regions and all but three industries (electric machinery, transportation and instruments) have experienced a negative employment record over the period.

[30] In 1990 a new classification system of industries was introduced (SNI92) and from 1994 the old classification system (SNI69) was no longer in use. We are grateful to Gudmundur Gunnarsson and Erik Mellander whose work has made it possible to translate the new industry classification scheme to the old system. Unfortunately this is only possible on a rather aggregated level.

Table 5

Job flows by industry. (Size-weighted, annual averages).

Industry	c	d	net	r	iwr_{min}	er	X_s/X
Mining	4.5	7.5	-3.0	12.0	8.7	6.5	1.4
Food	4.8	5.9	-1.1	10.6	6.2	8.8	8.4
Textile	4.3	9.6	-5.4	13.9	9.7	8.4	5.0
Wood etc.	5.0	7.3	-2.4	12.3	7.9	8.8	7.7
Paper	3.1	4.3	-1.3	7.4	4.8	5.3	6.8
Printing	4.4	5.8	-1.4	10.3	6.2	8.2	5.1
Chemicals	5.1	5.8	-0.7	10.9	6.9	8.1	5.3
Rubber	4.6	7.8	-3.2	12.4	8.3	8.1	1.2
Plastics	6.4	6.6	-0.2	13.0	8.6	8.8	1.5
Stone, clay & glass	4.7	7.9	-3.2	12.6	8.2	8.7	3.1
Primary metals	3.5	5.9	-2.3	9.4	6.4	5.9	6.7
Fabricated metals	6.0	7.4	-1.4	13.4	8.4	10.0	8.8
Nonelectric machinery	4.9	6.9	-2.0	11.8	7.6	8.4	13.4
Electric machinery	7.1	6.4	0.8	13.5	8.5	10.0	8.7
Transportation	4.8	4.8	0	9.6	6.8	5.6	11.2
Instruments	7.5	7.1	0.3	14.6	9.8	9.6	1.7
Shipyard	4.0	9.9	-6.0	13.9	11.2	5.4	3.2
Miscellaneous	5.0	7.9	-2.9	12.8	8.4	8.8	0.7
Size-weighted, cross-industry std. dev.	1.1	1.4	1.6	1.9	1.4	1.6	

Size-weighted, cross-industry correlations (marginal significance level)

ρ(c,d) = 0.18 (0.50) ρ(net,r) = -0.26 (0.31)

In Table 7 net and gross job flows are tabulated by size, age, ownership type, productivity, and wage costs.

Looking at the first panel, we note that smaller establishments are more dynamic than the larger ones are. Smaller establishments do not only create jobs in disproportional numbers, but they also destroy jobs in disproportional numbers. The smaller establishments have actually contributed more to the negative employment record, than the larger ones have.[31] Given the focus on small plants in the public discussion, it is also worth noting that, although the smaller establishments are more dynamic, a limited share of the work force is employed by them, why most jobs are actually created (and for that matter destroyed) in the larger establishments.

With respect to the age of the establishments, we find that younger plants create more jobs than the older ones do. Pretty soon after birth however, the number of jobs

[31] Qualitatively the statement does not change, but the results for the smallest plants (0-10) should be treated with some caution, especially what regards the net employment record, as there are some uncertainties surrounding these results due to the sampling scheme in IS.

destroyed is getting large, why there is no clear relationship between the net job creation rate and age.

With respect to another size-measure, whether the plant constitutes the whole firm or a part of a firm (single- or multi-plant), we find that the job reallocation rate is higher in the former type of establishments.

We find that job reallocation does more or less monotonically fall with wage costs and productivity. Low productive- and low wage cost plants tend to both create and destroy in disproportional numbers.

Table 6

Job flows by region. (Size-weighted, annual averages).

Region ("Län")	c	d	net	r	iwr_{min}	er	X_s/X
Stockholm	6.4	7.4	-1.0	13.8	8.3	11.0	11.7
Uppsala	4.9	7.3	-2.4	12.2	7.9	8.5	1.9
Södermaland	4.3	6.7	-2.4	11.0	7.2	7.5	3.7
Östergötland	4.8	6.4	-1.5	11.2	7.0	8.4	5.8
Jönköpning	4.9	6.1	-1.2	11.1	7.1	7.9	5.3
Kronoberg	5.2	5.9	-0.7	11.1	7.1	8.0	2.6
Kalmar	4.8	6.1	-1.3	11.0	7.1	7.7	3.7
Gotland	5.3	5.9	-0.6	11.1	7.9	6.5	0.4
Blekinge	4.3	5.8	-1.5	10.1	6.7	6.8	2.5
Kristianstad	5.4	6.8	-1.4	12.2	7.9	8.7	3.5
Malmöhus	4.8	6.9	-2.1	11.7	7.1	9.2	8.4
Halland	4.9	6.3	-1.4	11.1	7.0	8.3	2.4
Göteborgs och Bohus	5.1	7.1	-2.0	12.1	7.7	8.8	8.7
Älvsborg	4.5	6.2	-1.6	10.7	6.9	7.5	6.7
Skaraborg	4.9	5.3	-0.4	10.3	6.8	6.9	4.0
Värmland	4.4	6.2	-1.8	10.5	6.8	7.4	3.8
Örebro	4.2	6.0	-1.8	10.3	6.7	7.1	4.0
Västmaland	4.5	6.0	-1.5	10.5	7.0	7.1	4.5
Kopparberg	4.3	6.3	-2.0	10.6	7.0	7.2	3.8
Gävleborg	4.1	5.7	-1.6	9.7	6.5	6.4	4.2
Västernorrland	4.7	6.5	-1.8	11.2	7.2	8.2	2.9
Jämtland	6.3	7.5	-1.3	13.8	9.2	9.3	0.8
Västerbotten	5.3	6.2	-0.9	11.5	7.6	7.8	2.4
Norrbotten	5.8	6.4	-0.6	12.2	8.3	7.8	2.4
Size-weighted cross-industry std. dev.	0.7	0.6	0.5	1.1	0.6	1.3	

Size-weighted cross-industry correlations (marginal significance level)

$\rho(c,d) = 0.67$ (0.00) $\rho(net,r) = 0.19$ (0.40)

Table 7

Job flows by plant characteristics.

	c	d	net	r	iwr_{min}	er	X_s/X
Panel 1: Size (number of employed)							
1 – 10	7.8	13.6	-5.8	21.4	13.8	15.2	2.0
11 – 25	7.4	9.7	-2.3	17.0	10.2	13.6	7.5
26 – 50	6.8	8.5	-1.6	15.3	9.2	12.1	8.4
51 – 100	5.9	7.6	-1.7	13.5	8.2	10.5	10.7
101 – 250	5.1	6.8	-1.7	11.8	7.3	9.1	18.1
251 – 500	4.7	5.9	-1.3	10.6	6.6	8.0	14.4
501 – 1000	3.9	5.1	-1.1	9.0	5.9	6.3	15.1
> 1000	3.6	4.7	-1.1	8.3	5.8	5.1	23.9
Panel 2: Age (in years)							
0	200	0	200	200	200	0	0.3
0-2	7.9	11.0	-3.1	18.9	11.8	14.1	3.6
3-5	6.6	9.1	-2.4	15.7	10.4	10.7	4.4
6-10	5.8	7.9	-2.1	13.7	8.3	10.8	5.3
10 +	5.7	7.2	-1.5	13.0	8.4	9.1	7.2
n.a.	3.9	6.0	-2.1	9.8	6.3	7.1	79.2
Panel 3: Ownership type							
Single-plant	5.9	7.5	-1.6	13.5	8.3	10.4	33.0
Multi-plant	4.4	5.9	-1.5	10.4	6.4	7.9	67.0
Panel 4: Average labor productivity (decile)							
1:st	10.1	25.5	-15.4	35.6	25.5	20.2	5.8
2:nd	7.0	8.3	-1.3	15.4	9.5	11.7	5.6
3:d	4.5	6.8	-2.3	11.3	7.5	7.7	7.1
4:th	4.8	6.0	-1.2	10.8	7.1	7.5	8.6
5:th	4.5	5.8	-1.3	10.3	6.7	7.1	9.2
6:th	4.2	5.1	-0.9	9.3	6.0	6.6	10.1
7:th	4.0	4.7	-0.7	8.7	5.4	6.5	11.2
8:th	4.1	5.2	-1.1	9.4	5.9	7.0	12.6
9:th	4.5	4.5	0	8.9	5.6	6.7	14.1
10:th	5.1	4.3	0.8	9.3	5.9	6.9	15.6
Panel 5: Wage costs (decile)							
1:st	22.1	37.0	-14.9	59	38.1	41.7	5.8
2:nd	6.4	7.4	-1.0	13.8	8.6	10.5	5.6
3:d	5.6	5.7	-0.1	11.3	7.4	7.8	7.1
4:th	5.0	5.4	-0.4	10.4	6.5	7.8	8.6
5:th	4.8	5.2	-0.4	9.9	6.4	7.0	9.2
6:th	4.3	5.5	-1.1	9.8	6.2	7.2	10.1
7:th	4.1	5.3	-1.2	9.4	6.1	6.7	11.2
8:th	3.8	5.6	-1.8	9.4	6.1	6.6	12.6
9:th	3.8	5.2	-1.4	9.0	5.9	6.3	14.1
10:th	4.1	5.1	-1.0	9.2	5.8	6.7	15.6

Size refers to average employment in all years with positive employment in the establishment. (Qualitatively the results are the same if the current size is used).

The n.a. group for age includes plants born 1972 and prior.

Ownership type refers to whether the plant constitutes a firm (single-plant) or is a part of the firm (multi-plant).

Plants are categorized with respect to which decile of productivity and wage costs they belong to during the year.

So far we have established that there are no single bivariate relationships able to explain the simultaneous occurrence of job creation and destruction. We have also established that there is variation across sectors with respect to gross flows of jobs that, more or less, seems to conform to the theoretical considerations mentioned.[32]

Still, we cannot rule out the hypothesis that the observed heterogeneity is the result of various sectoral asymmetries working together. Consider how we can assess this hypothesis, by decomposing the excess job reallocation into the contribution from between-sector employment shifts and into the contribution from excess job reallocation (heterogeneity) within the sectors.[33]

Recall that our measure of heterogeneity, the excess job reallocation, is defined as $er = r - abs(net)$. By recognizing that the aggregate job reallocation rate is the size-weighted sum of the job reallocation rates in each sector and by adding and subtracting the size-weighted absolute sum of the net employment change rates in each sector, the excess job reallocation rate can be expressed as:

$$er = \sum_s \left(\frac{X_s}{X} \right) (r_s - abs(net_s)) + \sum_s \left(\frac{X_s}{X} \right) abs(net_s) - abs(net),$$

where s indexes measures applying for the sector. The first component measures the contribution of within-sector heterogeneity (excess job reallocation) in the employment outcome and the second component measures the contribution of between-sector employment shifts to the overall excess job reallocation. Thus, if the high level of aggregation causes the heterogeneity in the employment outcome across plants, the first component would approach zero as the economy is divided into sectors.

The results of such decompositions are presented in Table 8 (below). The sample is clustered with respect to 18 industries, 24 regions, three size classes, three wage classes, three productivity classes, two age classes and two ownership types.

Though cross-sector differences in the employment outcome account for some of the observed heterogeneity in the employment outcome, the inability to explain more is still the key fact reveled in Table 8. For instance, according to the first column, employment shifts across industries do on average account for no more than 8 percent, and

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[32] Qualitatively the results also, more or less, conform to what has been found in U.S. data as reported by Davis, Haltiwanger and Schuh (1996), namely that job reallocation is decreasing in size, age, wages, and productivity and that single-unit plants are more volatile than multi-unit plants.

[33] The decomposition appears in Davis and Haltiwanger (1992).

in no single year more than 22 percent, of the observed excess job reallocation.[34] Regional differences, as expected, explain even less of the observed heterogeneity. The simultaneous contribution to the observed heterogeneity of industry-, wage- and productivity effects is on average 27 percent; industry-, size- and age effects account for 21 percent; and industry-, region- and ownership-effects account for 35 percent. When we allow all these factors to interact, but regional effects, still less than half of the observed heterogeneity in the employment outcome can be explained by cross-sector shifts. This is not a lot considering the large number of sectors.[35]

Thus, the observed heterogeneity is not an artifact of the high level of aggregation, but, instead, most of the observed job reallocation in manufacturing takes place within narrowly defined sectors.

Table 8

Decomposition of excess job reallocation.

Sector division	Ind.	Reg.	Ind., Size, Age	Ind., Wage, Prod.	Ind., Reg., owner	Ind., Size, Age, Wage, Prod., Owner
# of sectors	18	24	108	162	864	2916
Fraction of excess job reallocation accounted for by:						
(a) Between shifts	0.08	0.05	0.21	0.27	0.35	0.47
(b) Within shifts	0.92	0.95	0.79	0.73	0.65	0.52
Std. dev.	0.08	0.05	0.09	0.11	0.09	0.07
Min (a)	0	0	0.04	0.08	0.17	0.34
Max (a)	0.22	0.19	0.32	0.45	0.48	0.58
Correlations between cross-industry job reallocation and wage dispersion (marginal significance level)						
$\rho(a_t, cvw_t)$= -0.23 (0.28)				$\rho(a{*}er, cvw_t)$= -0.11(0.60)		

Industries, regions and ownership are defined according to the definitions used in Table 6 and Table 7. Size, wage and productivity are defined in terms of which third of the industry distribution the plant belongs to. The three age classes are (1) 0-5 years old, (2) 6-10 years old and (3) older than 10 years or not accounted for. (The latter group refers to plants born prior to 1970).

In the finer divisions of manufacturing, the number of sectors reported contains cells that are empty.

The reported correlations are between the fraction of *er* due to cross-industry shifts and the level of *er* due to cross-industry shifts, on the one hand, and the cross-industry wage dispersion, measured as the squared coefficient of variation, on the other hand.

[34] If instead more detailed industries divide manufacturing, still only a very limited fraction of *er* can be explained by cross-sector shifts. Because of changes in the classification scheme this can only be done for the period 1972-1993 and for the period 1990-96, separately.

[35] As the economy is divided into more sectors, the more excess job reallocation will be explained, as the degree of freedoms decreases; in the limit, with each establishment constituting a sector, no heterogeneity would, of course, be left unexplained. In the finer divisions, the number of sectors is large as compared to the average 10 000 or so plants in the stock.

An interesting exercise in this context is to investigate whether any effects of the wage dispersion on the structure of the excess job reallocation can be found. According to the theoretical model of Bertola and Rogerson (1997), job reallocation is decreasing function in wage dispersion. Remember from the introductory remarks that the wage dispersion has increased in the Swedish manufacturing since sometimes around the mid-1980s when centralized negotiations where abandoned in favor of negotiations on the industry level. Although the increasing wage dispersion has been associated with increasing, rather than decreasing, job reallocation, still, one hypothesis is that cross-industry job reallocation became less important, as the wage dispersion between the industries increased. Data reveal that the wage dispersion across the industries indeed did increase.[36]

In the lower panel of Table 8 the correlation between the relative, *a*, the absolute, *a*er*, cross-industry job reallocation and the cross-industry wage dispersion is shown, respectively. Although the point estimates are negative, the relationships between the two are far from significant. Thus, with respect to cross-industry job reallocation we cannot detect any effect of the changes in the wage-setting system.[37]

5.2 Why does the intensity of job reallocation vary over time?

The results in the preceding section suggest that plant-level idiosyncrasies are important, in the sense that asymmetries across sectors account for only a small fraction of the heterogeneous employment outcome across plants.

How important, then, are idiosyncrasies in explaining the variation of job flows over time? Recall that the basic facts in section 4 included that job reallocation is countercyclical. This in turn has bearings on how we should characterize the business cycle; a well-stated macro economic theory trying to explain the cyclical pattern of jobs should

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[36] The negative result may be due to the fact that the match between industries and contract areas (and trade unions) is far from perfect. Therefore we, in the next section, also consider within-industry effects of increases in the wage dispersion.

[37] In the reported correlations the between-industry wage dispersion is measured as the sum of the size-weighted within-industry wage (cost) dispersion subtracted from the total wage dispersion across plants. Wage dispersion is here measured as the squared coefficient of variation. The results are qualitatively the same if other dispersion measures are considered. If we in a regression analysis control for other factors, such as the dispersion in productivity across industries and the manufacturing growth rate, we still cannot detect any significant relationship between cross-industry wage dispersion and cross-industry job reallocation.

be able to come up with a rationale for why idiosyncrasies in the employment outcome become more important in times of contraction.[38]

However, before such a claim is made, we must rule out the possibility that the observed countercyclical pattern is an artifact of not having controlled for possible aggregate and sectoral mean translation effects on the plant-level growth rate density. That is, the observed countercyclical pattern could be the result of contractions as times of increased heterogeneity across sectors and not necessarily by increased heterogeneity within the sectors. There is nothing incoherent in recognizing the importance of idiosyncrasies in explaining the cross-sectional variance in job flows, but at the same time argue the importance of aggregate forces in explaining the variation in job flows over time.

Davis and Haltiwanger (1992) finds that there is an increased role for idiosyncrasies in times of contraction. However, this does not need to be the case for Sweden. Arguments have been put forward as to why the cyclical behavior of job flows depends on the structure of adjustment costs (Garibaldi, 1998; Boeri, 1996). In particular, one prediction is that if dismissal costs are relatively high, job flows are more procyclical than would be the case otherwise. Given the extensive employment protection in Sweden, institutionalized by LAS, the cyclical properties of job flows need, therefore, not to be the same as in the U.S.

To discriminate between the view that the variation in job flows is mainly driven by aggregate forces from the view that idiosyncrasies are important also in this sense, the plant-level growth rate is decomposed into an aggregate, a sectoral, and an idiosyncratic component. Let $\tilde{g}_{et}$ be the idiosyncratic component in plant-level growth and let $\overline{net}_{st}$ be the deviation in the sector growth grate from the aggregate growth, net_t, i.e.

$$\tilde{g}_{et} = g_{et} - \overline{net}_{st} - net_t .$$

Utilizing the idiosyncratic gross flow measures (denoted by tildes) calculated from the idiosyncratic distribution of growth rates, the overall variance in the job reallocation rate can be decomposes as

$$\mathrm{var}(r_t) = \mathrm{var}(\tilde{r}_t) + \mathrm{var}(r_t - \tilde{r}_t) + 2\mathrm{cov}(\tilde{r}_t, r_t - \tilde{r}_t),$$

[38] Theoretical models acknowledging this fact include Blanchard and Diamond (1990), Davis and Haltiwanger (1990), and Caballero and Hammour (1995)

where $\tilde{r}_t = \sum_{e \in s} \frac{x_{et}}{X_{st}} \tilde{g}_{et}$.[39]

The identifying assumption is that if the variation over time in the job reallocation rate would be completely driven by aggregate and/or sectoral forces, the distribution of the idiosyncratic growth rates would be time-invariant. In terms of the decomposition, this implies that $\text{var}(\tilde{r}_t) \to 0$ and that all variance in job reallocation can be accounted for by aggregate and sectoral mean translation effects on the distribution of growth rates, as measured by the second term. The covariance term reflects the part of the variation that cannot unambiguously be assigned to either aggregate or idiosyncratic effects.

Table 9 (below) presents the results from such decompositions under different assumptions about the nature of shocks. In the first column the assumption is that shifts in the aggregate growth, net_t, is the only driving force of the variation in job reallocation; i.e. the distribution of $\tilde{g}_{et} = g_{et} - net_t$ is time-invariant. This view is extended in the following columns to allow also for sectoral deviations with respect to industry, size, ownership type, age, region, wages, productivity and combinations thereof.

There is no question about the message from panel 1 in Table 9. The contributions from aggregate and sectoral mean effects account only for a minor fraction of the observed variance in job reallocation; the second term in the variance decomposition accounts for between zero and six percent of the variance in the job reallocation rate. Even if the whole covariance term is assigned to the aggregate and sectoral effects, the contribution is still limited.

However, looking at the second and third panel of Table 9, aggregate shift stories seems to be more important in explaining the variation over time in job destruction and job creation, respectively. What explain the relationships between the behavior of job reallocation and the behavior of job creation and job destruction, are the covariance results. For job destruction, the covariance results indicate that idiosyncratic effects

[39] Also this decomposition appears in Davis and Haltiwanger (1992). Note that the concept of heterogeneity is extended using the idiosyncratic job reallocation rate in comparison to the excess job reallocation rate. Whereas the excess job reallocation rate only measures the extent to which jobs are created and destroyed simultaneously, the idiosyncratic job reallocation rate in addition takes into account differences in the growth rate across industries.

strongly reinforce the countercyclical movements, whereas for job creation, the covariance results indicate that idiosyncratic effects counteract the procyclical movement.

Panel 4 reports the size-weighted average correlation between the idiosyncratic job reallocation rate and the own-sector employment growth rate. We note that the negative countercyclical movements in job flows are remarkably uniform across the various sectors. For instance, the correlations are negative in all but one industry.

Thus, if anything, aggregate and sectoral effects reinforce, rather than explain, the finding that job reallocation is countercyclical. The countercyclical property of job flows is thus not an artifact unique to U.S. manufacturing, but is also pervasive in Swedish manufacturing.

Table 9

Decomposition of time-series variance in job reallocation.

Sectors	Tot Mfg.	Ind.	Reg.	Ind., Size, Age	Ind., Wage, Prod.	Ind., Reg., Owner	Ind., Size, Age, Wage, Prod., Owner
# of sectors	1	18	24	864	162	864	2916
Panel 1: Fraction of job reallocation variance accounted for by (a) Sectoral/aggregate mean effects and (b) Idiosyncratic effects:							
(a)	0	0.01	0	0.02	0.02	0.03	0.06
(b)	0.93	0.92	0.93	0.91	0.88	0.80	0.62
2cov(a,b)	0.07	0.07	0.07	0.07	0.10	0.18	0.32
Panel 2: Fraction of job creation variance accounted for by (a) sectoral/aggregate mean effects and (b) idiosyncratic effects:							
(a)	1.36	1.37	1.34	1.38	1.29	1.29	1.13
(b)	0.97	0.96	0.97	0.96	0.91	0.84	0.74
2cov(a,b)	-1.32	-1.33	-1.31	-1.34	-1.20	-1.13	-0.87
Panel 3: Fraction of job destruction variance accounted for by (a) sectoral/aggregate mean effects and (b) idiosyncratic effects:							
(a)	0.37	0.37	0.38	0.36	0.39	0.39	0.45
(b)	0.25	0.25	0.24	0.25	0.24	0.22	0.19
2cov(a,b)	0.38	0.38	0.37	0.39	0.37	0.39	0.36
Panel 4: Average, size-weighted correlations between net_t^s and $\tilde{r}_t^s$							
ρ	-0.61	-0.63	-0.60	-0.51	-0.34	-0.30	-0.26
(#<0/total)	1/1	17/18	23/24	112/163	131/162	593/844	1506/2755

See comments in Table 8 for definitions of the various sectors.

While the previous results provide strong evidence in favor of the countercyclical behavior of the heterogeneity in the employment outcome across plants, they say little about the magnitude of the covariances between net overall and sectoral growth rates, on the one hand, and sectoral job reallocation rates, on the other hand.

To investigate the covariance structure, we, in Table 10 (below), regress the rates of idiosyncratic job reallocation on the manufacturing net employment growth and the own-sector net employment growth deviated about the manufacturing growth. The regressions also contain sectoral fixed effects to control for permanent sectoral differences in the intensity of job reallocation.

For instance, in regression (1) the idiosyncratic job reallocation rates in the 18 industries are regressed on the time varying covariates and 18 fixed industry effects. The time varying covariates are highly significant and together they account for 50 percent of the variation in industry job reallocation rates. The covariance structure implies that a one standard deviation decline in the manufacturing (own-industry) growth rate is associated with an increase in sectoral job reallocation rates of 6.04 (3.81) percentage points.

Relative to the time-varying covariates in regression (1), regressions (2)-(4) adds interactions of size-, age-, ownership-, productivity- and wage cost dummies, respectively. A number of interesting results emerge.

Large movements in the idiosyncratic job reallocation rates are associated primarily with movements in the manufacturing employment growth rate, rather than with movements in the own-sector employment growth rate.

The covariation between the manufacturing employment growth rate and the idiosyncratic sectoral job reallocation rates is larger among smaller plants than in larger plants, among low productive plants than in high productive plants, and among low wage cost plants than in high wage cost plants.[40] A similar but less pronounced pattern is found with respect to the own-sector growth rate. The results with respect to plant age are a bit peculiar; whereas young plants seem to be strongly countercyclical in overall growth, they seem to be strongly procyclical in own-sector growth.

[40] That the countercyclical property of job reallocation is more pronounced among the smaller than among the larger plants is not in accordance with what have been found in U.S. data (Davis and Haltiwanger, 1992). This is an interesting result, since it has been argued that the countercyclical pattern of job flows is an artifact of the size distribution of plants in manufacturing (Boeri, 1996).

Table 10

Regressions of idiosyncratic job reallocation on employment growth rates

Division of Manufac-turing Industry and	R^2		Average response to a one std. deviation increase in Mfg. growth rate	Own growth rate
(1) -	0.50		-6.04** (0.38)	-3.81** (0.31)
(2) Size	0.38	small	-5.10** (0.35)	-3.39** (0.30)
		medium	-3.40** (0.34)	-1.22** (0.22)
		large	-1.90** (0.34)	-1.05** (0.25)
(3) Age	0.29	young	-4.91** (0.68)	4.37** (0.56)
		old	-2.98** (0.68)	-1.83**(0.56)
(4) Ownership	0.24	single	-2.92** (0.29)	-0.74** (0.20)
		multi	-2.06** (0.29)	-1.55** (0.18)
(5) Labor productivity	0.14	low	-3.29** (0.38)	-1.14** (0.24)
		medium	-1.77** (0.38)	-0.58* (0.28)
		high	-1.72** (0.39)	-1.04** (0.27)
(6) Wage cost	0.12	low	-4.49** (0.48)	-0.72* (0.30)
		medium	-1.44** (0.47)	0.13* (0.32)
		high	-1.94** (0.48)	-1.50** (0.35)

Standard errors are reported in parenthesis. * (**) next to the parameter indicates significance at the 5- (1-) percent level.

In computing the estimated responses, a one standard deviation increase in the covariate is measured as the size-weighted average of the time-series standard deviation in the covariate.

All regressions contain fixed effects to control for permanent differences across the sectors.

The R^2 equals the fraction of time-series variation explained by (a) and (b) and is obtained from a regression of the deviations about the sectoral fixed effect in the idiosyncratic job reallocation rate on (a) and (b).

To further exploit the covariance structure, we append a number of interesting covariates to regression (1) that could contribute to explain the idiosyncrasies in the employment outcome. The appended covariates are measures of within-industry wage and productivity dispersion, growth in productivity, average plant size and the number of plants.

So far we have not found any indications supporting the hypothesis that increased wage dispersion results in lower job reallocation: The rise in the unadjusted job reallocation rate has been associated with an increasing, rather than with a decreasing, wage dispersion and the between sector job reallocation was found to be more or less uncorrelated with the between-sector wage dispersion. However, this could be an artifact of not having controlled for other important covariates, such as the productivity dispersion. It could very well be the case that the effects of the rising wage dispersion on job flows has been counteracted by a rise in the productivity dispersion.

Based on the argument that many of the results so far can be interpreted in terms of theoretical models that stress that the process of growth at the micro level is associated with a great deal of experimentation with different input mixes and methods of production, we include the growth rate in productivity. The hypothesis is that the heterogeneity is increasing in productivity growth.

The average plant size in the sector is included, as size has been found to be an important factor in the preceding analysis. On a more fundamental level one could argue that intra-industry job reallocation would be decreasing in the average plant size, if the covariate serves as a proxy for minimum efficient scale and barriers to entry.

Finally, the number of plants in the sector is included. If the number of plants serves as a proxy for concentration and market power, then job reallocation is expected to increase as the demand become more elastic.

The result of such regression is presented in Table 11. We note that the effects of the employment growth rates remain more or less intact when the additional covariates are appended to regression (1) in Table 10. The net employment growth rates are the single most influential factors in the covariance structure.

We stress that the regression in Table 11 only presents the covariance structure and that the estimated parameters are not to be interpreted as casual effects. Still, it is interesting to note that, even we add other controls, including the dispersion in productivity, any effects of changes in the wage dispersion are still not detectable.[41]

Besides the employment growth covariates, the variable affecting the idiosyncratic growth rate the most is the manufacturing growth in productivity: A one standard deviation increase in the productivity growth is associated with a 1.49 percentage point increase in the idiosyncratic job reallocation rate. This effect is also highly significant. Primarily idiosyncrasies in the employment outcome seems to be associated with movements in the manufacturing growth rate of productivity, rather than with movements in the own-sector growth rate (deviated about the manufacturing growth rate).[42]

The covariations between the productivity dispersion and average plant size, on the one hand, and the job reallocation, on the other hand, also enter the regression with expected signs and are significant at the 5 percent level. We do not find any significant

[41] This result seems to be robust against experimenting with other wage dispersion measures and against the inclusion and exclusion of other variables.

[42] If the unadjusted own-sector growth rate in productivity is used, instead of the manufacturing growth rate in productivity, the results are unaffected, in the sense that own-sector growth in productivity is associated with relatively large increases in job reallocation and that the effect is highly significant.

effects of the number of plants, which is maybe not so surprising given that the covariate probably is not a very good proxy for concentration.

Table 11

Determinants of Idiosyncratic Job Reallocation

Dependent variable: Rates of Idiosyncratic Job Reallocation		
Covariate	Percentage response to a one std deviation increase in:	Standard error
(a) Mfg.net growth rate	-5.38**	(0.46)
(b) Own net growth rate	-3.44**	(0.30)
Ind. Wage Disp.	0.38	(0.43)
Ind. Prod. Disp.	0.88*	(0.35)
Mfg. Growth in Prod.	1.49**	(0.46)
Ind. Growth in Prod.	0.36	(0.42)
Ind. Avg. Plant Size	-0.47*	(0.28)
Ind. No. of Plants	0.09	(0.19)
F	49.07	

* (**) next to the parameter indicates significance at the 5- (1-) percent level.

All regressions include fixed industry effects to account for permanent differences between the industries in the job reallocation rate.

All covariates, except (a) and (b), are in logarithms. (The growth rate in labor productivity is measured as the log difference). The dispersion covariates are defined in terms the squared coefficient of variation. Qualitatively the results remain the same if other dispersion measures are used, i.e. 90 to 10 percentile ratios.

Whether the insignificant covariates are included or not, does not affect the results qualitatively.

In computing the estimated responses, a one standard deviation increase in the covariate is measured as the size-weighted average of the time-series standard deviation in the covariate.

6. REALLOCATION OF INPUTS AND LONG-RUN PRODUCTIVITY GROWTH

Most of the results so far can be interpreted as indirect evidence in favor of models that acknowledge reallocative activities as important in the process of growth and the adoption of new technology at the micro level. Also, in the regression analysis in the preceding section, we found the growth rate in productivity to be associated with large movements in job reallocation; beside employment growth, changes in growth rate of productivity was found to be the single most influential factor in the covariance structure.

Therefore, it seems natural, as a final exercise, to inquire into the importance of job reallocation in explaining the long-run growth in productivity.

The importance of job reallocation in the process of growth is hardly a new idea, but has been around since the days of Schumpeter. The notion of *Creative Destruction* involves the necessity to replace old technologies in order to adopt new ones. Modern vintage capital models emphasize the role of entry and exit (e.g. Caballero and Hammour; 1995) and retooling (e.g. Cooper, Haltiwanger and Power; 1997) as important mechanisms by which this process is taking place.

Following the methodology of Baily, Hulten and Campell (1992), we assess the importance of reallocation of inputs and outputs in explaining the long-run growth in productivity using the following decomposition methodology: Our measure of the aggregate productivity is given by

$$P_{st} = \sum_{e \in s} s_{et} p_{et} \ ,$$

where p_{et} is the productivity in the *e:th* unit at period t and s_{et} is its share of employment.[43] The change in aggregate productivity in the *s: th* sector between period t - 1 and period t can be decomposed in the following way:

$$\Delta P_{st} = \sum_{e \in s,c} s_{et-1} \Delta p_{et} + \sum_{e \in s,c} \left(p_{et-1} - P_{st-1} \right) \Delta s_{et} + \sum_{e \in s,c} \Delta s_{et} \Delta p_{et}$$
$$+ \sum_{e \in n} s_{et} \left(p_{et} - P_{st-1} \right) + \sum_{e \in x} s_{et-1} \left(p_{et-1} - P_{st-1} \right),$$

where c indexes continuing plants, n indexes entering plants and x indexes exiting plants.[44]

The first term (the within share), measures how much of the growth in productivity that would have taken place without any changes in the distribution of employment shares across the units.

The second term (the between share) measures how much of the productivity growth that is due to shifts in the distribution of employment shares across the units, given their initial productivity relative to the aggregate.

The third term (the cross term) is a covariance term, which is interpreted as the fraction of productivity growth that cannot unambiguously be assigned to either of the former sources.

The last two terms measure the contribution from entering and exiting plants, respectively (the entry and exit share). If the entering plant has higher productivity than the aggregate productivity in the base period, it will contribute positively, otherwise not.

[43] As a measure of plant-level productivity we use the producer-price deflated, average labor productivity.
[44] American studies decomposing the aggregate productivity across plants include Baily, Hulten, and Campbell, (1992); and Foster; Haltiwanger, and Krizian (1998).

Similarly, if the exiting plan has a lower productivity than the aggregate productivity it will contribute positively, otherwise not.

Table 12 presents the results of such decompositions.[45] The following results emerge: Over the 1972-96 period, we note that 40.7 percent of the productivity growth would have occurred even if the shares of employment among the continuing plants would have had remained unchanged.[46] The flip side of this is that some 60 percent of the growth in productivity over the period can be attributed to various activities that include reallocation of employment shares. The small between share tells us that the role for reallocation of employment shares from low to high productive plants has been quite small. Another 21.2 percent of the growth in productivity was due to the fact that productivity changes and employment shares moved in the same direction; plants experiencing growth in productivity also tended to increase their shares of employment and vice versa. The contribution from entering plants is substantial, which is not so surprising given the long time span.[47]

Several interesting results emerge when the decomposition is carried out for three different periods. The three sub-periods correspond to 1972-80; a period characterized by a low annualized growth rate in productivity; to 1980-88, a period with medium-high growth rate; and 1988-96, a period when the pace of productivity growth was fast.

We find that, although within-plant changes in productivity has accounted for a relatively large fraction of the overall growth in productivity in each period, this is far from the only mechanism contributing to growth.

Over the 1972-80 period, the low rate of growth in productivity was achieved in a way that could be characterized as a labor saving. The large contributions from both the within and the between term is counteracted by a large cross term, which implies that

[45] The decomposition could of course have been conducted on the level of sectors, e.g. industries, instead of for the whole manufacturing. However the purpose here is mainly to show the importance of job reallocation in accounting for the growth in productivity. If, however, the decomposition is conducted in each of the 18 industries, the size-weighted results are qualitatively not very different from the results reported in Table 12. Furthermore, if the decomposition is undertaken across industries, as opposed to across plants, we find that almost all productivity growth is due to within-industry changes.

[46] This statement is not completely true, since the within component also account for possibly important growth effects that can be attributed to reallocation of employment shares that are reversed within the sample interval.

[47] This is partly an artifact of the decomposition. As the entering plant's productivity is compared to the aggregate productivity in the base period, entering plants will generally contribute more, the longer the sample interval is.

most plants that experienced productivity increases also experienced decreases in their employment shares. This is also true, but to a lower extent, for the 1980-88 period. In this period, within-plant changes were the dominating source of the, somewhat higher, growth in productivity.

Already the fact that the 1988-96 period is characterized by a very fast pace of productivity growth is interesting. The change in the way productivity growth came about in this period is also striking. In contrast to the earlier periods, within-plant changes were a less predominant source of growth. Also, we find a positive and large cross term, which implies that most plants that experienced productivity growth also increased their employment shares.

In accordance with the view that entry and exit are important features in the process of growth (Caballero and Hammour, 1995), we find that the overall contribution from plant turnover has been positive in each of the period considered. In the 1972-80 period this is true as a consequence of a substantial contribution from exiting plants (at least in relative terms). Entering plants, on the other had, did in fact contribute negatively. In the 1989-96 period, we note that the role for entry is quite important; together with exiting plants, entering plants accounted for some 10 percent of the high growth in productivity.

Table 12

Decomposition of long-run growth in productivity.

Period	Annualized Growth	Within Share	Between Share	Cross Share	Entry Share	Exit Share
1972-96	3.2	40.7	4.9	21.2	30.3	2.8
1972-80	0.7	70.3	53.6	-39.0	-14.0	29.1
1980-88	3.7	84.0	15.1	-8.7	5.5	4.1
1988-96	5.1	57.6	14.3	17.2	8.8	2.1

The conclusion from this exercise must be that the reallocation of inputs across plants plays an important role in accounting for the growth in aggregate productivity. Furthermore, the relative importance of each component varies substantially with the period studied. With respect to the 1988-96 period, as compared to the previous periods, it is particularly interesting that we find that a large fraction of the fast pace of growth in productivity can be attributed to reallocative activities and that the growth came about in a quite different way. These are indeed interesting facts as they suggest that the increases in the job reallocation rates in the 1990s are closely associated with the way growth came about.

7. SUMMARY

As a stylized fact we found large gross flows of jobs, over and above what is needed to accommodate the net change in employment, to be a pervasive phenomenon in Swedish Manufacturing. However, the average pace of job reallocation has been considerably slower than in U.S. Manufacturing.

The intensity of job reallocation has varied considerably over time. Masked behind low averages, we found periods of large-scale job reallocation. In particular, the 1990s are characterized by very high rates of job reallocation, telling us that primarily increasing job destruction accommodated the dramatic fall in employment in the early 1990s, rather than decreasing job creation. In general, we found that job reallocation exhibits countercyclical movements.

A large fraction of worker flows is the direct result of demand factors, in the sense of being induced by the reshuffling of jobs across work-sites rather than anything else. This claim is based upon two observations. First, we found that, at the very least, some 26-41 percent of the actual worker reallocation in the typical year during the 1985-96 period was directly induced by shifts in the distribution of employment positions across plants. (The residual being attributed to heterogeneity over and above establishment heterogeneity and to life cycle motives). Also, it seems like that the importance of job flow in explaining total worker reallocation increases in times of contraction.

Second, we found that job flows are highly concentrated to plants experiencing large changes in employment; some 60 percent of job destruction and some 50 percent of job creation took place in plants shrinking and growing by more than 20 percent during the course of a year, respectively.

Also in terms of concentration a shift in the reallocation process was detected: In the 1989-96 period job flows were found to be much more concentrated to plants experiencing large employment changes. These facts suggest that normal worker attrition can be expected to accommodate only a minor fraction of the observed job flows.

Observed job flows were also found to be highly persistent phenomena, which implies that job flows cannot be expected to be implemented through temporary layoff and recall policies either.

Based on these findings it seems safe to conclude that job flows are highly correlated with various economic phenomena: Job destruction is likely to be highly correlated with the inflow into unemployment and outflow from the labor force; associated consequences clearly include the variation in personal income and the burden placed upon the social insurance systems. Job creation is, for the same reasons, likely to be associated with bottleneck problems; the associated consequences include retarded growth.

Motivated by the consequences for the individual concerned and the importance for the economic outcome, the following questions naturally arose: *Why are jobs being created and destroyed simultaneously* and *what causes the pace of job reallocation to vary over time?*

Inquiring into what might explain the simultaneous occurrence of job creation and destruction lead us to reject the hypothesis that the heterogeneity is the resulting sum of cross-sectional variation in the net employment outcome. The heterogeneity of the plant-level employment outcome is a pervasive phenomenon even within narrowly defined sectors of the manufacturing sector.

However, the intensity of job reallocation differs with respect to observable characteristics of the plant; in particular the job reallocation rate is higher among smaller, younger, single-unit, low productive, low-wage cost plants than among plants characterized by the opposite.

Aggregate and sectoral shift stories did not have any greater success in explaining why the job reallocation varies over time. Instead, a strong finding is that the plant-level idiosyncrasies dominate the variation in job reallocation. The countercyclical behavior of job reallocation was found to be pervasive across sectors, but this pattern seems to be especially pronounced in smaller, low-productive and low-wage cost plants.

In the quest for the answers to the above-mentioned questions, we acknowledged that the institutional setting in the Swedish Manufacturing is quite different from the U.S. counterpart, for instance.

A tentative explanation for the discrepancy between Swedish and U.S. manufacturing with respect to the average pace of job reallocation could be made in terms of larger adjustment costs in the Swedish economy.

Another institutional fact that, at least in theory, has been argued to be important to explain high European job flow rates, is the level of wage compression. However, in Swedish manufacturing we find no evidence of this effect: Contrary to the prediction, the rise in the wage dispersion was associated with higher rates of job reallocation. The rises in the wage dispersion between and within industries have not been associated with decreasing job reallocation neither between the nor within industries. The latter result was found to be robust against the inclusion of additional controls, including the productivity dispersion.

Many of the findings in this study, we think, are in accordance with models that acknowledge growth and adoption of new technology as a noisy process, filled with experimentation and uncertain outcomes. In particular, the findings that the low productive firms both create and destroy jobs in disproportional numbers and that the countercyclical pattern of job reallocation is more pronounced among low productive than high productive plants, are in accordance with this view. Also, we found that the single most important factor in the covariance structure of the idiosyncratic job reallocation, besides the employment growth rates, was the growth in productivity.

Having found evidence in favor of a close relationship between job reallocation and the process of growth, we finally asked how important the reallocation of inputs and outputs have been in accounting for the long-run growth in productivity. We concluded that various reallocative activities have contributed substantially to the growth in productivity. For instance, over the 1972-96 period some 60 percent of the growth in productivity could be attributed to activities that include the reallocation of inputs across plants. Furthermore, we found that the way growth came about varied a lot in different periods. Because of the apparently different job reallocation pattern in this period, it was particularly interesting that we found an increased and, as compared to the other periods, a different role of the various reallocative activities in accounting for the rapid growth in productivity in the 1988-96 period.

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