Cohort effects and Catch-Ups in Wages and Promotions

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Abstract

This paper shows that there are three kinds of cohort effects in wages depending on when they enter a labor market (labor market cohort), when they enter an occupation (occupation cohort), and when they enter a firm (firm cohort). We find that labor market cohort and occupation cohort effects are pro-cyclical. However, when labor market and occupation cohort effects are controlled, firm cohort effects become partially counter-cyclical. This finding contradicts the prediction of common long-term (implicit) contract models. This paper also shows that most cohort effects in wages are driven by cohort effects in promotions. In particular, workers entering a particular rank during a recession are promoted more slowly than workers entering the same rank during a boom. We find that a worker-occupation matching model is most consistent with our findings.

I. Introduction

The wages of workers' entering a firm in the same year often move together independent of current market conditions, in what is called the cohort effect in wages. Previous economic studies found that this cohort effect in wages is pro-cyclical (see Beaudry and DiNardo 1991;Baker, Gibbs, and Holmstrom 1994; Devereux 2002). That is, workers entering a firm during a recession not only receive lower wages in the beginning, but also continue to receive lower-than-average wages even after the economy recovers.

The existence of cohort effects may have some serious implications for the efficiency of economy. College graduates may delay their market entrance; MBAs may be less motivated given that they paid an equal amount for an MBA degree but will not get the same returns as other cohorts. Also, we can seriously under-estimate the effect of business cycle and of the policies that affect the business cycle if the effect persists over time through cohort effects.

This paper investigates what drives the cohort effect in wages. There are several theoretical explanations in the literature, but few studies have attempted to distinguish them.

First, we show that there are three kinds of cohort effects depending on when workers enter a labor market (labor market cohort); when they enter an occupation (occupation cohort); and when they enter a firm (firm cohort). We argue that separating these cohort effects allows us to distinguish different theoretical explanation. For example, when we control labor market cohort and occupation cohort effects, firm cohort effects become partially counter-cyclical. That is, workers entering a firm during a recession receive higher-than-average wages in the long-run. This finding is hard to reconcile with long-term implicit contract models suggested in Beaudry and DiNardo (1991) or BGH (1994).

Second, we show that a large portion of cohort effects in wages are driven by promotions. For example, workers entering the same rank during a recession are promoted more

slowly than others entering the same rank during a boom. As we discuss below, this finding is hard to reconcile with job-specific human capital model (e.g. Gibbons and Waldman 2003) or stigma model..

In order to distinguish labor market, occupation, and firm cohort effect, one needs workers' entry years to labor market, firm, and occupation. And in order to distinguish between wage and promotion driven cohort effect, ones needs data on occupation, rank, and promotion. The Swedish employer-employees matched data have all this information. The data encompasses the entire population of establishments and workers in the private sector (except insurance and banks) and includes detailed information on occupation, ranks within occupations, and wages.

Most previous empirical studies have focused on firm cohort effects in wages and found pro-cyclical firm cohort effects (e.g. Baker, Gibbs and Holmstrom 1994, Beaudry and DeNardo 1991). However, few have distinguished labor market, occupation, and firm cohort effects. Also there are few studies that analyze cohort effects in promotions.[1]

The paper is organized as follows: In section II, we summarize six potential explanations for cohort effects and analyze how their predictions can differ. Section III describes the data and the labor market institution in Sweden. In section IV, we present the empirical findings. Section V discusses our findings and attempt to distinguish different theoretical explanations. We conclude in Section VI.

II. Theoretical Explanations and Previous Empirical Findings

In the economic literature there are theoretical models/explanations that provide plausible explanations of cohort effects in wages. We have identified six different models below

1. Composition or sorting model

[1] Solon et al (1997) and Devereux (2000) found that during recessions workers were assigned to lower ranks. But they did not study its long term effect.

2. Downward stickiness of wages and ranks
3. Implicit long term contract
4. Stigma model
5. Human Capital model
6. Matching model

From these six models we can derive some predictions of cohort effects on wages using the variables such as labor market, firm, and occupation cohort effects in wages and in promotions.

The *sorting model* claims that the composition of worker skills can differ with business cycles.[2] For example, if during a boom, more high-skilled workers enter the labor market/firm/occupation than during a recession, they will be promoted faster and hence receive a higher wage than at other times. In this case the cohort effects will be pro-cyclical. A prediction in this model is that once we control for **individual characteristics,** cohort effects of all types should disappear.

The *Downward stickiness of wages* idea suggests that if during a boom workers receive higher wages/ranks than at other times, the wages and ranks will stay even during recessions. Hence, this will predict pro-cyclical labor market, firm and occupation cohort effects both in wages and in promotions. Another prediction is that those who were hired during the boom will have slower **promotion rates** than those hired during the recession because firms would want to demote these workers but are prohibited doing so and can only delay promotion.[3]

[2] In Clark and Summers 1980 they found that the composition age differed during boom and recessions.
[3] The idea of downward stickiness of wages and ranks have rendered some empirical support in the US (Baker, Gibbs and Holmstrom 1994 and for Sweden (Gibbs, Ierulli and Meyersson Milgrom 2003, and for wages only in Agell and Lundborg 1997).

The *implicit long term* contract model explains how that market conditions at the time of signing the contract determines the workers long term wages.[4] One of the predictions of this model is that during a recession workers' long term wage contracts generate lower future wages than otherwise. Thus, even when we **control for labor market and occupation cohort effects, firm cohort effect will be pro-cyclical.** Baker Gibbs and Holmstrom 1994 and Beaudry and DiNardo 1991 found pro-cyclical firm cohort effects in wages and interpret their empirical findings as evidence of long term contracts. They did not, however, control for labor market and occupation-cohort effects.

The *Stigma Model* predicts that workers entering at lower ranks during a recession will signal that they are low skill workers and therefore will receive fewer outside offers. Hence, this model predicts that workers entering lower ranks during recession will have slower promotion rates and wage growth. Therefore there will be **pro-cyclical labor market and firm cohort effects** in wags and promotions. In contrast, the model predicts no occupation cohort effects for those who change occupation within the firm, since firm already know worker productivity. Yet another prediction is if we control for workers starting ranks, there should be no cohort effect. The logic is that all workers starting at the same rank will have the same stigma.

The Human Capital model (Gibbons and Waldman's version 1998, 2003) argues that workers entering the labor market at recession will end up in dead-end jobs or jobs with little or no learning opportunities and hence low skill accumulation. This in turn leads to less promotion. Therefore, there will be pro-cyclical cohort effects on promotion. But if starting rank is controlled for there should be no cohort effect of any type on wages and promotions since they all accumulate the same kind of skill.

Finally the *Matching model* argues that there be more job opening during a boom and hence workers will find better matches with occupations. Better match leads to better productivity and hence faster promotions and higher wages. This predicts pro-cyclical cohort effects on wages and promotions. Another prediction is that promotion rates will

[4] See for a theoretical model Harris and Holmstrom 1982.

be faster for those who entered an occupation during a boom than in recession even after controlling for starting rank and occupation. Consistent with the assumption of the matching model is that more workers will change occupations during a boom than during a recession.

III. Institution and Data

The Swedish longitudinal data of white collar workers, an employer –employee matched data set used in this paper covers the period 1986-1989. The data base served as the input to the centralized wage negotiations and were gathered from personnel records by The Swedish Federation of Employers and monitored by the labor unions.

The information in the data base consists of individual and occupation characteristics, firm information such as plants, industry, region. Individual characteristics include information such as age, education, occupation, rank, wage, work-time status.
Occupation is captured by the BNT code a four digit code where the 3 first digits describes types of tasks and the fourth rank measured as degree of skill needed to fulfill the tasks. (number of employees and type of skill needed for decisions at this level). The white-collar workers' occupations cover altogether 276-285 positions.
Ten occupation areas and 51 occupation groups, for instance construction and design, with detailed information about task content. Each of the 51 consists of 3 digits. Within each group a further distinction is made with respect to the level of difficulty in the job, the fourth digit. A code that runs from 2 high and 8 low. Not all occupations span the entire 7 rank, some start higher and some do not have the top ranks.

Note that that the occupation titles are not so fine as to rule out all the individual worker-firm bargaining. Figure 1 shows that there are large wage variations within occupations and within firms (see Kwon and Meyersson 2004a and Meyersson and Petersen 1998a)

[Figure 1 here]

In Table 1 we show a description of the sample used in the analysis based on firms with more than 100 white-collar workers and where only full time white-collar workers are included. Any new white-collar entrants over 40 are excluded and new firms, dying firms, and firms under merger or split are excluded. We also exclude the observations when education is missing (20% of sample). Including them by assigning separate education code does not change our results.

[Table 1 here]

Although the centralized wage bargaining system had not yet dissolved the period 1986-1989 it is a period less pervasive of centralized wage negotiation and more of locally determined wage bargaining. After 1983 the central wage bargaining system started to dissolve. For the vast majority of all employees after 1988 wages were determined by industry level and plant level bargaining (Calmfors and Forslund 1990).

Although employers are by law the sole decision maker when it comes to hiring and promotion, firing workers was strictly regulated by law and monitored by the labor union. Very few workers were fired or laid off except when the firm could claim that the jobs had become redundant. (for a more through description of the labor market see Kwon and Meyersson Milgrom 2004a).

IV. Empirical Results

A. Firm Cohort Effects in Wages

This section shows that we can replicate the results of previous studies on cohort effects when we control for firm cohort effects only.

First, we replicate the analysis of Beuadry and DiNardo (1991) – henceforth BD. In Table 2, we run a series of wage regressions controlling for age, firm tenure, firm size, firm growth rate, gender, industry, town, and occupation. In addition, we control for the

contemporaneous unemployment rate (henceforth CUR), the unemployment rate at the start in the firm (henceforth SUR_F), and the minimum unemployment rate since the start in the firm (henceforth MUR_F). As in BD, when these unemployment rates are controlled for individually, each rate has a negative and significant effect, with the MUR_F having the largest coefficient (see column [1] - [3]). However, column [6] shows that when we control for all these rates simultaneously, the CUR has the largest effect, and the MUR_F has a significant and negative effect. The SUR_F has the smallest effect and a positive sign.

[Table 2 here]

These results are overall very similar to BD. In particular, the negative effect of MUR_F is consistent with an implicit long-term contract model of Harris and Holmstrom (1982) as argued in BD.

Second, we also replicate the cohort analysis of BGH. We estimate the effects of workers' firm starting years in a wage regression using cohort (or starting year) dummy variables. As is well-known, however, cohort effects cannot be identified when controlling for both tenure and time effects. (see BGH or Hall 19??) In particular, the linear components of cohort, tenure, and time effects cannot be identified. Nevertheless, we can still test for joint significance of the starting year dummies. Furthermore, we can still estimate the cohort effects without the linear trend (i.e., deviations from the linear trend).

Thus, we run the following wage regression:

$$\log(wage_{it}) = \alpha_0 + \alpha_1 \tau_{it} + \alpha_2 \tau_{it}^{\ 2} + \alpha_3 \tau_{it}^{\ 3} + \beta_t I_t + \gamma_{t-\tau} J_{t-\tau_{it}} + X_{it}\gamma + \varepsilon_{it} \qquad (1)$$

where wage is measured by hourly real wage. τ_{it} is worker $i's$ tenure at a firm in year t. I_t is the year dummy, and $J_{t-\tau_{it}}$ is the (firm) cohort dummy. X_{it} includes individual characteristics such as age, gender, town, industry, (three-digit) occupation, firm size,

firm growth rate, and education. Since the linear component of cohort, tenure, and time effects cannot be identified, we detrend $\hat{\gamma}_{t-\tau}$ after estimation. Figure 2 shows these detrended coefficients of cohort dummies along with employment rate (1-unemployment rate)..

[Figure 2 here]

The figure shows that firm cohort effects overall follow the employment rate, especially after 1982. This finding is overall consistent with that of BGH.

B. Labor Market Cohort, Occupation Cohort, and Firm Cohort Effects in Wages

While most studies of cohort effects have focused on the workers' starting years at a firm (i.e. firm cohort effects), different cohort groups can be formed based on workers' starting years in the labor market or in an occupation. However, we have little understanding on whether there exist these different cohort effects or how these cohort effects are related.

Thus, in this section, we study the labor market cohort, occupation cohort, and firm cohort effects in wages. As discussed above, these distinctions will also allow us to test some of the theoretical models of cohort effects.

First, building on BD's specification, we add the unemployment rates when workers started in the labor market and in an occupation. We also add the minimum unemployment rates since workers started in the labor market and in an occupation.

[Table 3 here]

In Table 3, column [1] shows that among the unemployment rates at the starting year, the unemployment rate at the start of an occupation (henceforth SUR_O) has the largest effect, while the unemployment rate at the start of the labor market (henceforth SUR_L) and the

SUR_F are relatively small. In addition, the SUR_L has a positive sign. Column [2] shows that among the minimum unemployment rates since the starting years, the minimum unemployment rate since the start of an occupation (henceforth MUR_O) has the largest effect, and the effects of the minimum unemployment since the start of the labor market (henceforth MUR_L) and the MUR_F are relatively small. When we control for all the unemployment rates at the same time, column [5] shows that the CUR has the largest effect, while the SUR_O and the MUR_L also have significant effects on wages. On the other hand, the SUR_F , the MUR_F , the SUR_L and the MUR_O have small and positive effects.

These results suggest that the market conditions at the start of a current occupation are more important than those at the start of a firm. Also, the most favorable market condition since the start of a labor market is more important than that since the start of a firm. Furthermore, firm cohort effects are counter-cyclical. These results are difficult to reconcile with the models of long-term implicit contract.

We can also estimate the general cohort effects by controlling for the starting years in the labor market, occupation, and firm as dummy variables rather than controlling for the unemployment rates in starting years. We then linearly de-trend the coefficients of each set of cohort as discussed above.[5] Figure 3 shows the employment rate (= 1 – unemployment rate) and the de-trended coefficients of each set of cohort dummies when other individual characteristics X_{it} in (1) are *not* controlled for.

[Figure 3 here]

Note that occupation cohort effects follow business cycle very closely. Given that we have used only four years of data (1986-1989), it is remarkable to recover the business cycle in 10-15 years ago. Labor market cohort effects are also partially pro-cyclical. They follow the business cycle very closely after 1981.

[5] This is essentially equivalent to dropping the first and the last dummies as suggested by Hall (19??).

Also note that firm cohort effects are partially counter-cyclical. Thus, the pro-cyclical firm cohort effects in Figure 2 are entirely due to labor market and occupation cohort effects. Once we control for labor market and occupation cohort effects, firm cohort effects turn counter-cyclical. This is a significant finding because previous empirical studies have found pro-cyclical firm cohort effects without controlling for labor market and occupation cohort effects and, consequently, some theoretical models are built on the assumption of pro-cyclical firm cohort effects.

These cohort effects would be less interesting if they are entirely due to different composition of each cohort. Thus, we re-estimate these cohort effects controlling for individual characteristics such as age, gender, town, firm size, firm growth rate, and industry. We also control detailed education dummies which have 351 different categories. Figure 4 shows that there are surprisingly little changes in cohort effects.

[Figure 4 here]

Then, what drives these cohort effects? Several theories (such as Stigma or Human Capital) suggest that ranks and promotions are important driving factors of cohort effects. Thus, in the next section, we study the cohort effects in promotions.

C. Cohort Effects in Promotion

The cohort effects in wages can arise because different cohorts may enter different ranks and are promoted at different speed. Thus, some cohort may reach higher ranks and receive larger wages than other cohorts. In this case, the wage cohort effects are entirely driven by the promotion cohort effects. Thus, the wage cohort effects should disappear once we control for workers' current ranks.

[Figure 5 here]

Figure 5 shows the cohort effects in wages when we control for workers' current rank in their occupations. Note that most variations of cohort effects have disappeared. This result strongly suggests that promotion is the driving force of cohort effects in promotion.

[Figure 6 here]

Thus, we estimate the cohort effects in promotion more directly. We use the same specification as before, but put each worker's current rank in their occupations as dependent variable. Figure 6 shows that the promotion cohort effects are almost identical to the wage cohort effects in Figure 3 or 4. This result confirms that wage cohort effects are mainly driven by cohort effects in promotion.

[Figure 7 here]

Different cohorts may reach different ranks either because they started at different ranks or because they were promoted at different rate. To investigate whether there are cohort effects in promotion rates, we use the number of promotions in a worker's current occupation as a dependent variable. Figure 8 shows that there are significant pro-cyclical occupation cohort effects in promotion rates. That is, workers entering an occupation during a recession are promoted more slowly than others entering during a boom. Compared with occupation cohort effects, labor market cohort and firm cohort effects in promotion rates are relatively very small.

These results suggest that there is no catch-up in promotion. Workers who started at lower ranks during a recession do *not catch up* those (otherwise similar) workers who entered at higher ranks during a boom. In fact, the gap between these two cohort groups may increase because of the pro-cyclical occupation cohort effects in promotion rates.

We also look at the set of workers who started their career at occupation 800 (Marketing) rank 5 and who have not changed either the occupation nor firm. Note that since these workers started at the same rank, the cohort effects in this sub-sample workers, if exist, will not be due to the differences in starting ranks. Figure 8 shows that there are clear

pro-cyclical cohort effects in wages. Figure 8 (b) shows that these pro-cyclical cohort effects are due to the fact that workers hired during a boom have been promoted faster than others hired during a recession.

[Figure 8 here]

V. Discussions

Our empirical results allow us to distinguish different theoretical models discussed in section II.

First, according to the sorting model, once we control individual characteristics, all the cohort effects will disappear. In the empirical analysis we control for observable individual characteristics such as detailed information about education a proxy for skill and find no decrease in cohort effects.

Second, according to the downward stickiness explanation workers entered the labor market during a boom should exhibit slower promotion than others. In our empirical analysis we find no support for this prediction, instead workers entering an occupation during booms will be promoted faster than others.

Third, implicit long-term contract model predicts that the firm-cohort effect should be pro-cyclical. According the empirical results, when controlling for labor market and occupation cohort effects, firm cohort effects are partially counter-cyclical.

The model cannot explain pro-cyclical labor market and occupation-cohort effects, because workers do not sign contracts with a labor market or with an occupation.

Fourth, the stigma model predicts there will be no occupation cohort effects for workers who change occupation within the firm because the firm already knows the worker's productivity. The empirical results show no such results. To the contrary the occupation cohort effect are still significantly pro-cyclical even within firms. The stigma model also

predicts that controlling for the starting rank, the all cohort effects should disappear. The empirical results do not support this prediction. Instead workers starting at the same rank during a recession are promoted slower than others starting at this same rank.

Fifth, the human capital model, Gibbons and Waldman (2003), predicts that in a recession workers enters at lower ranks with limited opportunities to learn or acquire important skills for promotions therefore will reach lower ranks. Even though this model is consistent with broad patterns of our empirical findings, it does not explain the finding that workers during recessions starting at the same rank are promoted slower and reach lower ranks than others starting at the same rank but at other times.

Sixth, the matching model predicts that even when controlling for the starting rank there will be cohort effects, because workers entering the same rank during a boom are likely to find better match, and this in turn is consistent with more workers changing of occupations, being promoted more often.

All the predictions from the matching model received support from the empirical analysis.

VI. Conclusion

In our empirical analysis we find the existence of labor market, firm and occupation cohort effects in wages. The driving force behind these effects is entered rank and the speed of promotion.

Labor market and occupation cohort effects follows business cycles so that in recessions workers enters lower ranks, and are promoted slower than in a boom. Firm cohort effects on the other hand are partially counter-cyclical.

We also find that prediction derived from matching models are more consistent with the empirical results than other models such as human capital, implicit long term contract, stigma and sorting models.

These are findings in Sweden. In future studies of countries with different institutional settings would add to knowledge of how cohort effects emerge, persist and disappears.

These new empirical results could serve as inputs into future theoretical work on the workings of cohort effects and its effects on the economic system as a whole.

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Appendix A Three-Digit Occupation Codes

BNT Family	BNT Code	Levels	
0			**Administrative work**
	020	7	General analytical work
	025	6	Secretarial work, typing and translation
	060	6	Administrative efficiency improvement and development
	070	6	Applied data processing, systems analysis and programming
	075	7	Applied data processing operation
	076	4	Key punching
1			**Production Management**
	100	4	Administration of local plants and branches
	110	5	Management of production, transportation and maintenance work
	120	5	Work supervision within production, repairs, transportation and maintenance work
	140	5	Work supervision within building and construction
	160	4	Administration, production and work supervision within forestry, log floating and timber scaling
2			**Research and Development**
	200	6	Mathematical work and calculation methodology
	210	7	Laboratory work
3			**Construction and Design**
	310	7	Mechanical and electrical design engineering
	320	6	Construction and construction programming
	330	6	Architectural work
	350	7	Design, drawing and decoration
	380	4	Photography
	381	2	Sound technology
4			**Technical Methodology, Planning, Control, Service and Industrial Preventive Health Care**
	400	6	Production engineering
	410	7	Production planning
	415	6	Traffic and transportation planning
	440	7	Quality control
	470	6	Technical service
	480	5	Industrial, preventive health care, fire protection, security, industrial civil defense
5			**Communications, Library and Archival Work**
	550	5	Information work
	560	5	Editorial work – publishing
	570	4	Editorial work – technical information
	590	6	Library, archives and documentation
6			**Personnel Work**

	600	7	Personnel service
	620	6	The planning of education, training and teaching
	640	4	Medical care within industries
7			**General Services**
	775	3	Restaurant work
8			**Business and Trade**
	800	7	Marketing and sales
	815	4	Sales within stores and department stores
	825	4	Travel agency work
	830	4	Sales at exhibitions, spare part depots etc.
	835	3	Customer service
	840	5	Tender calculation
	850	5	Order processing
	855	4	The internal processing of customer requests
	860	5	Advertising
	870	7	Buying
	880	6	Management of inventory and sales
	890	6	Shipping and freight services
9			**Financial Work and Office Services**
	900	7	Financial administration
	920	6	Management of housing and real estate
	940	6	Auditing
	970	4	Telephone work
	985	6	Office services
	986	1	Chauffeuring

Appendix B Sample Description of Four-Digit Occupation Codes

Occupation Family 1: Occupation # 120- Manufacturing, Repair, Maintenance, and Transportation
11% of 1988 sample
There is no rank 1 in this occupation.
Rank 2 (4% of occupation # 120 employees) - Assistant for unit; insures instructions are followed; monitors processes
Rank 3 (46%) -In charge ofa unit of 15-35 people
Rank 4 (45%) - In charge of 30-90 people; does investigations of disruptions and injuries
Rank 5 (4%) - In charge of 90-180 people; manages more complicated tasks
Rank 6 (0.3%) - Manages 180 or more people
There is no rank 7 in this occupation.

Occupation Family 2: Occupation #310- Construction
10% of the 1988 sample
Rank l (0.1%) - Cleans sketches; writes descriptions
Rank 2 (1%) - Does more advanced sketches
Rank 3 (12%) - Simple calculations regarding dimensions, materials, etc.
Rank 4 (45%) - Chooses components; does more detailed sketches and descriptions; estimates costs
Rank 5 (32%) - Designs mechanical products and technical products; does investigations; has 3 or more subordinates at lower Ranks
Rank 6 (8%) - Executes complex calculations; checks materials; leads construction work; has 3 or more subordinates at rank 5
Rank 7 (1%) - Same as rank 6 plus has 2-5 rank 6 subordinates

Occupation Family 3: Occupation #800- Marketing and Sales
19% of 1988 sample
Rank l (0.2%) - Telesales; expedites invoices; files
Rank 2 (6%) - Puts together orders; distributes price and product information
Rank 3 (29%) - Seeks new clients for 1- 3 products; can sign orders; does market surveys
Rank 4 (38%) - Sells more and more complex products; negotiates bigger orders; manages 3 or more subordinates
Rank 5 (20%) - Manages budgets; develops products; manages 3 or more rank 4 workers
Rank 6 (7%) - Organizes, plans, and evaluates salesforce; does more advanced budgeting; manages 3 or more rank 5 workers
Rank 7 (1 %) - Same as rank 6 plus 2-5 rank 6 subordinates

Occupation Family 4: Occupation #900- Financial Administration
5% of 1988 sample
Rank 1 (1%) - Office work; bookkeeping; invoices; bank verification
Rank 2 (7%) - Manages petty cash; calculates salaries
Rank 3 (18%) - More advanced accounting; 4-10 subordinates
Rank 4 (31 %) - Places liquid assets; manages lenders; evaluates credit ofbuyers; manages 3 or more rank 3 employees
Rank 5 (28%) - Financial planning; analyzes markets; manages portfolios; currency transfers; manages 3 or more rank 4 employees
Rank 6 (12%) - Manages credits; plan routines within the organization; forward-looking budgeting; manages 3 or more rank 5 employees
Rank 7 (2%) - Same as rank 6 plus 2-5 rank 6 subordinates

Table 1 Summary Statistics

Year	Number of workers	Age (mean)	Female (%)	# of Firm Changers	# of Occup. Changers	# of New Entrants	Wage (mean)	Number of Firms	Firm Size (mean)	Number of Occupation	Occupation Size (mean)
1986	181,589	40.9	23	6,903	10,334	12,079	12,127	570	373	51	7,531
1987	189,315	40.9	23.3	7,915	10,984	11,915	12,857	593	377	51	7,609
1988	196,495	40.8	24.1	9,454	13,132	14,072	13,833	636	369	51	7,853
1989	191,494	40.5	24.9	9,581	13,911	15,798	15,260	630	369	51	7,938

Note: New firms, dying firms, and firms under merger or split are excluded. New entrants with age over 40 are excluded.

Table 2 Firm Cohort Effect Only

(dependent variable=log(hourly real wage))

	[1]	[2]	[3]	[4]	[5]	[6]
Contemporaneous Unemployment Rate	-.06444 (.00053)			-.06629 (.00061)	-.05602 (.00113)	-.05411 (.00116)
Rate at the Start of Firm		-.01600 (.00099)		.00518 (.00108)		.00863 (.00120)
Minimum Rate since Start of Firm			-.06835 (.00072)		-.01217 (.00149)	-.01939 (.00174)
Number of Obs.	534,938	534,938	534,938	534,938	534,938	534,938
R-square	0.43	0.42	0.43	0.43	0.43	0.43

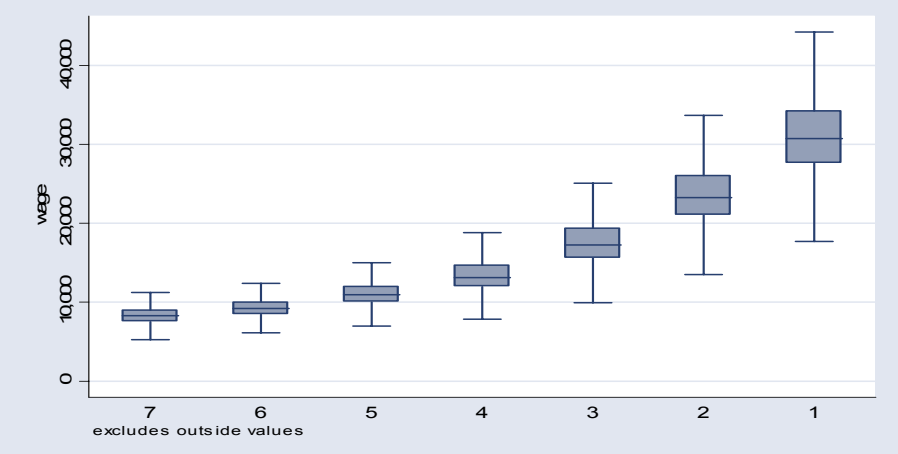
Note: Standard errors are in parentheses. The dependent variable is log hourly real wage (1970 Kronor). All regressions include age, firm tenure, firm tenure-squared, firm size, firm size growth rate, gender, industry dummies, town dummies, occupation dummies, and year dummies. The standard errors are adjusted for correlation within individual.

Table 3 Labor Market Cohort, Occupation Cohort, and Firm Cohort
(dependent variable=log(hourly real wage))

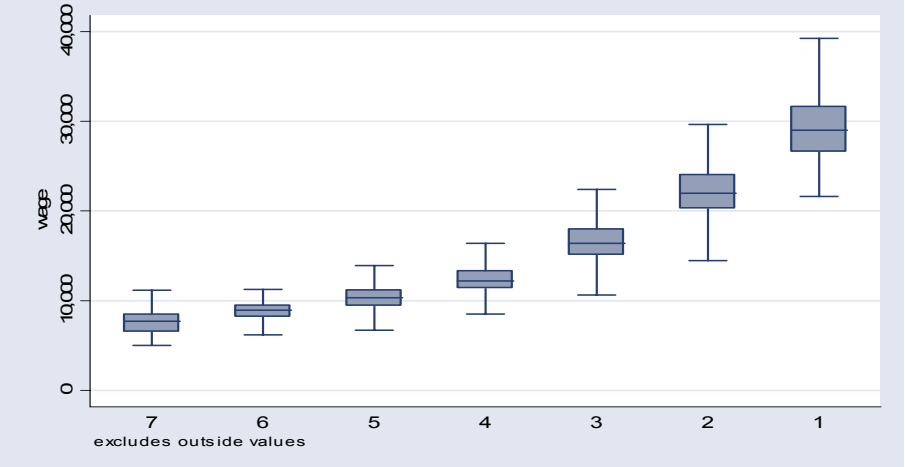
	[1]	[2]	[3]	[4]	[5]
Contemporaneous Unemployment Rate			-.06159 (.00063)	-.05487 (.00128)	-.05893 (.00135)
Rate at the Start of Labor Market	.00749 (.00144)		.00342 (.00144)		.00677 (.00152)
Rate at the Start of Firm	-.00408 (.00132)		.01376 (.00138)		.01262 (.00151)
Rate at the Start of Occupation	-.02797 (.00135)		-.01954 (.00136)		-.01812 (.00153)
Minimum Rate since Start of Labor Market		-.00803 (.00250)		-.02562 (.00258)	-.03169 (.00264)
Minimum Rate since Start of Firm		-.01735 (.00207)		.02462 (.00228)	.01434 (.00249)
Minimum Rate since Start of Occupation		-.04596 (.00219)		-.01543 (.00243)	.00477 (.00259)
Number of Obs.	534938	534398	534398	534398	534398
R-square	0.457	0.461	0.463	0.463	0.463

Note: Standard errors are in parentheses. The dependent variable is log hourly real wage (1970 Kronor). All regressions include age, labor market experience, experience-squared, firm tenure, firm tenure-squared, occupation tenure, occupation tenure-squared, firm size, firm size growth rate, gender, industry dummies, town dummies, and occupation dummies. The standard errors are adjusted for correlation within individual.

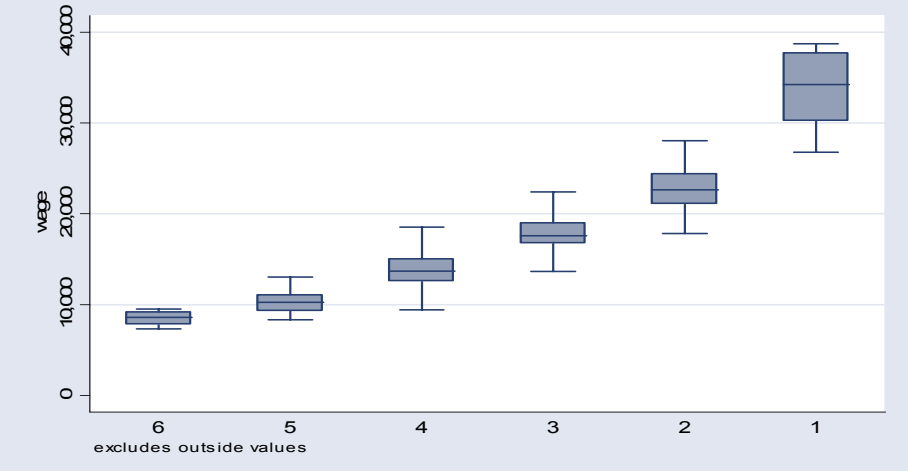
Figure 1 Wage Distribution and Rank



(a) All Firms



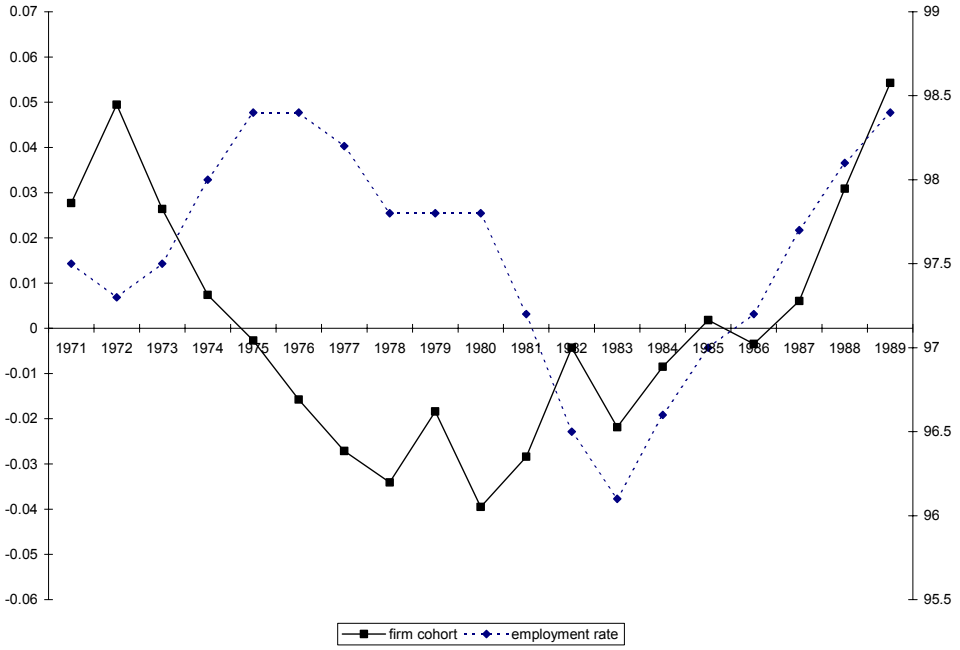
(b) The largest firm



(c) Occupation=800 in the largest firm

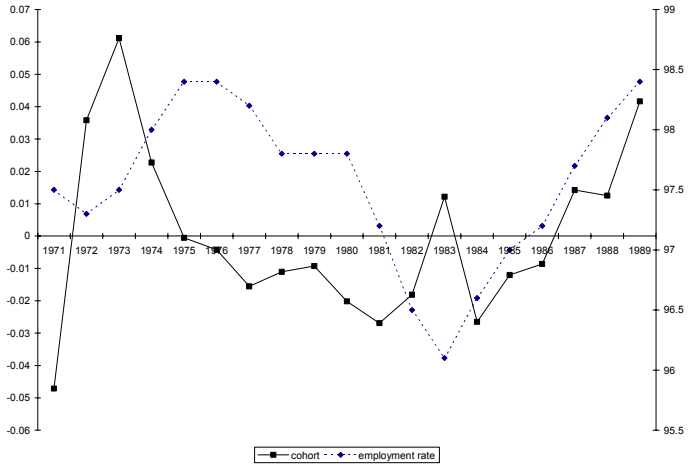
Note: These figures show the box plots of wages in 1988.

Figure 2 Firm Cohort Effects Only

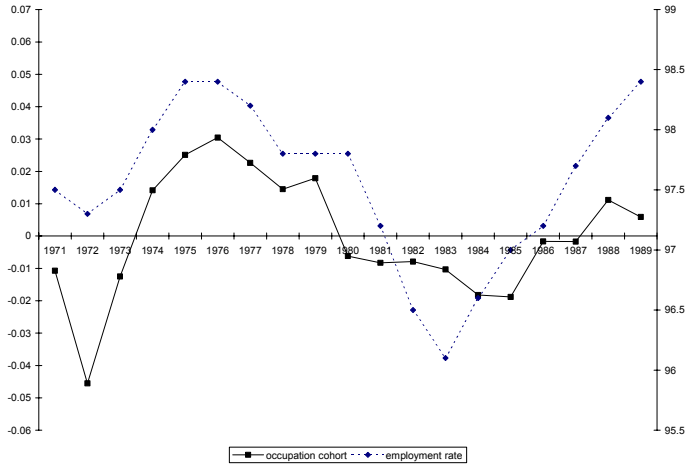


Note: The figure displays the employment rate (=1-unemployment rate) and the linear de-trended coefficients of firm starting year dummies in the wage regression. The dependent variable is log hourly real wage. The regression includes age, labor market experience, firm tenure, occupation tenure, firm starting year dummies, firm size, firm size growth rate, gender, education dummies, industry dummies, town dummies, occupation dummies and year dummies.

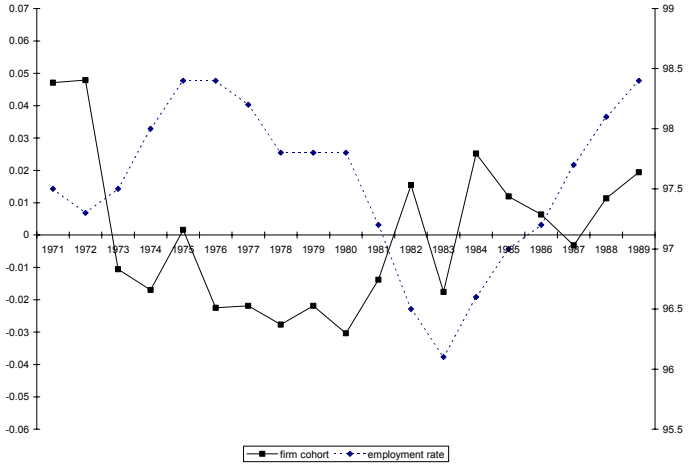
Figure 3 Cohort Effects in Wages
(without controlling for individual worker characteristics)



(a) Labor Market Cohort



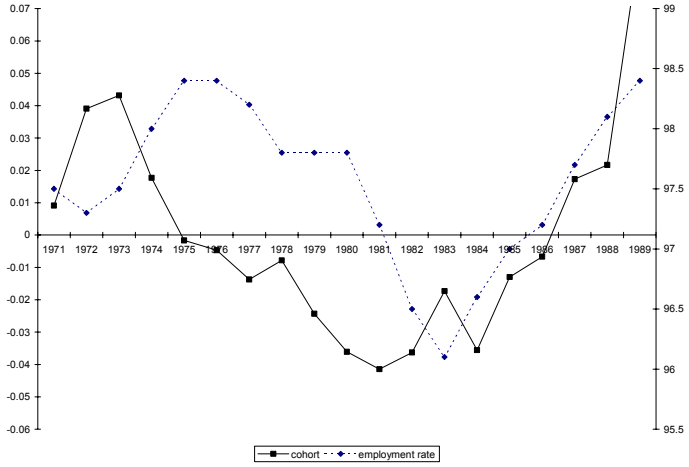
(b) Occupation Cohort



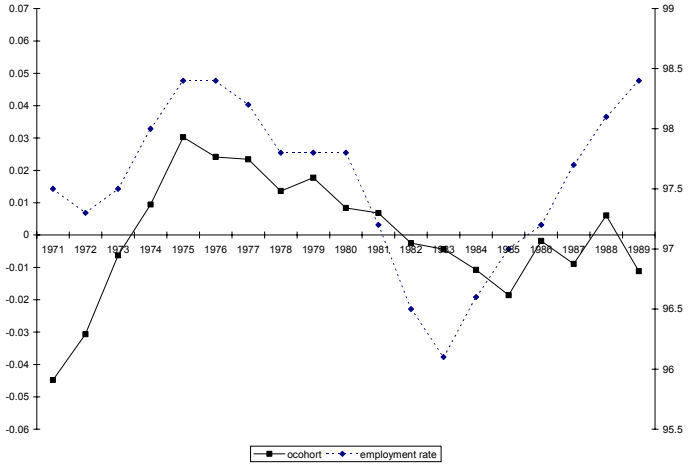
(c) Firm Cohort

Note: The figure displays the employment rate (=1-unemployment rate) and the linear de-trended coefficients of firm starting year dummies in the wage regression. The dependent variable is log hourly real wage. The regression includes labor market experience, firm tenure, occupation tenure, labor market starting year dummies, occupation starting year dummies, firm starting year dummies, and year dummies.

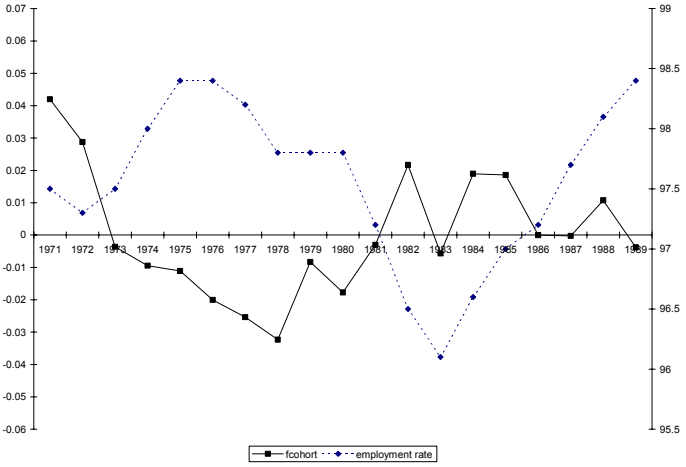
Figure 4 Cohort Effects in Wages
(controlling for individual characteristics)



(a) Labor Market Cohort Effects



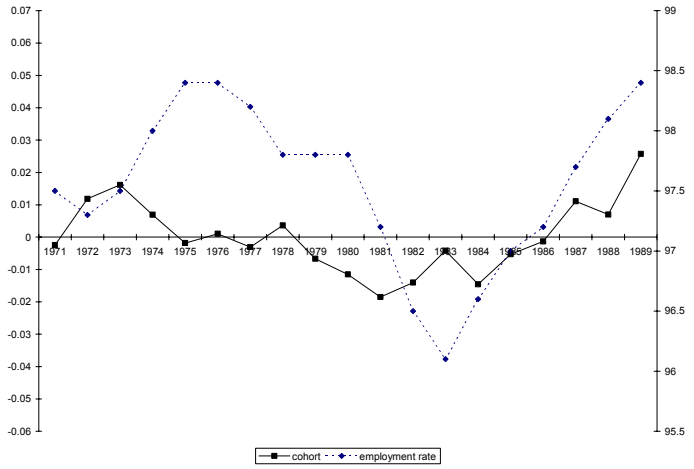
(b) Occupation Cohort Effects



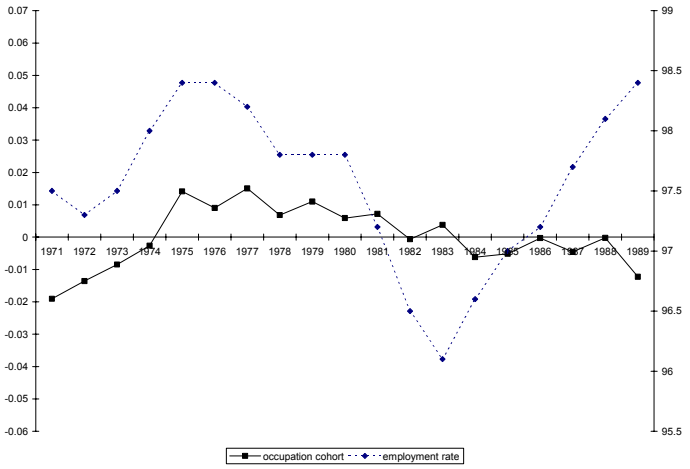
(c) Firm Cohort Effects

Note: The figure displays the employment rate (=1-unemployment rate) and the linear de-trended coefficients of firm starting year dummies in the wage regression. The dependent variable is log hourly real wage. The regression includes age, labor market experience, firm tenure, occupation tenure, labor market starting year dummies, occupation starting year dummies, firm starting year dummies, firm size, firm size growth rate, gender, education dummies, industry dummies, town dummies, occupation dummies and year dummies.

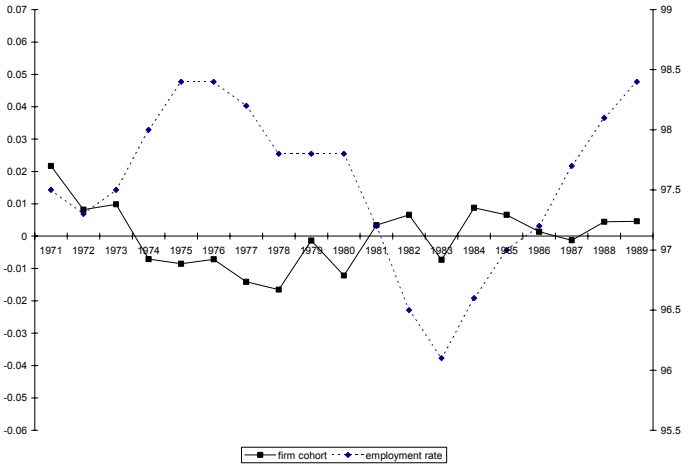
Figure 5 Cohort Effects in Wages
(Controlling for Ranks)



(a) Labor Market Cohort



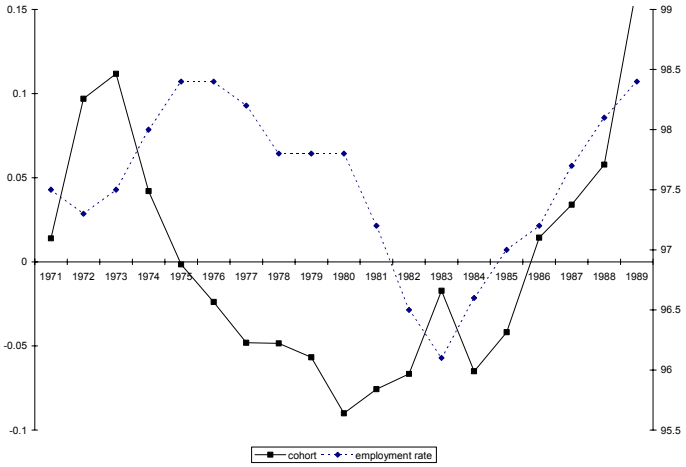
(b) Occupation Cohort



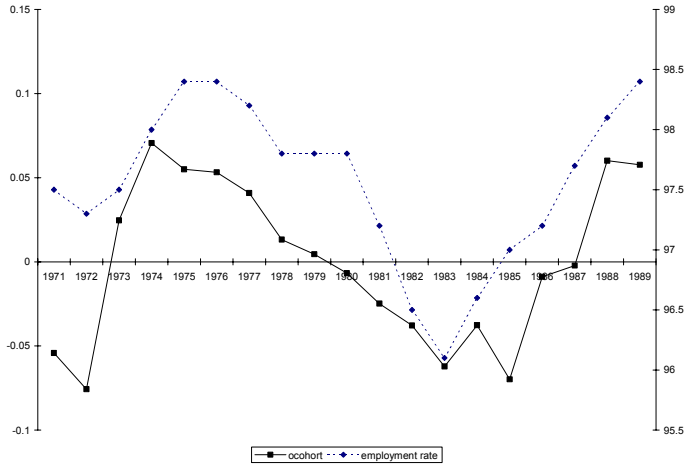
(c) Firm Cohort

Note: The figure displays the employment rate (=1-unemployment rate) and the linear de-trended coefficients of firm starting year dummies in the wage regression. The dependent variable is log hourly real wage. The regression includes age, labor market experience, firm tenure, occupation tenure, labor market starting year dummies, occupation starting year dummies, firm starting year dummies, rank dummies, firm size, firm size growth rate, gender, education dummies, industry dummies, town dummies, occupation dummies and year dummies.

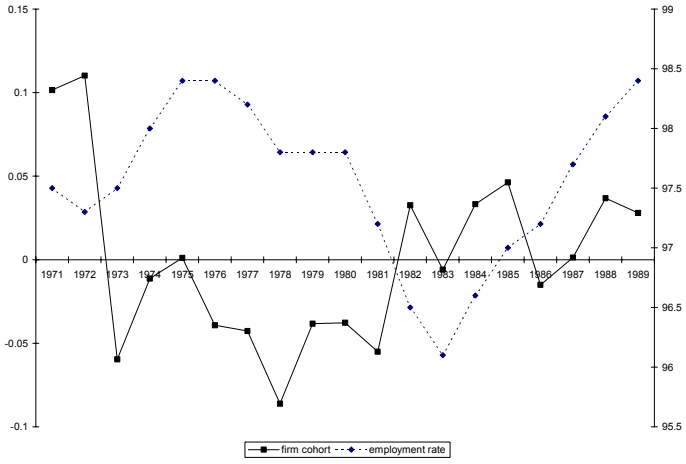
Figure 6 Cohort Effects in Reached Ranks
(dependent variable=rank in current occupation)



(a) Labor Market Cohort



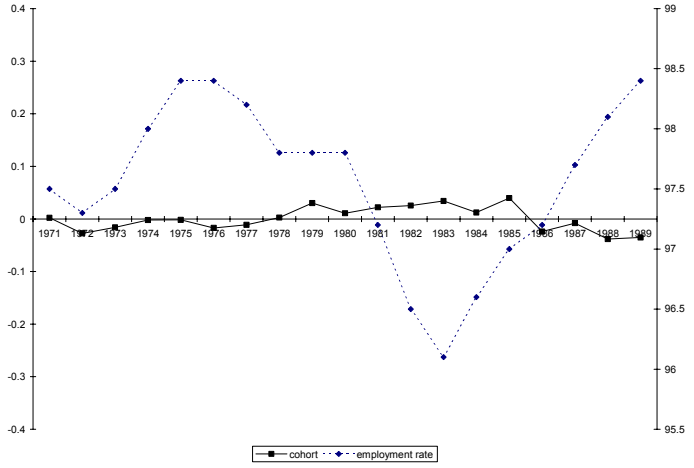
(b) Occupation Cohort



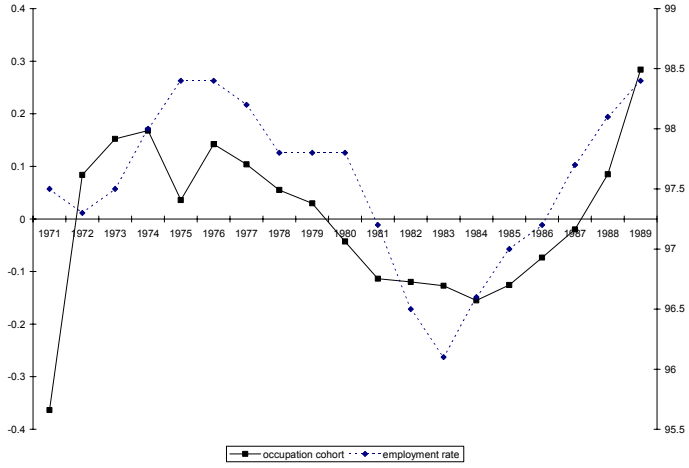
(c) Firm Cohort

Note: The figure displays the employment rate (=1-unemployment rate) and the linear de-trended coefficients of firm starting year dummies in the rank regression. The dependent variable is current rank. The regression includes age, labor market experience, firm tenure, occupation tenure, labor market starting year dummies, occupation starting year dummies, firm starting year dummies, firm size, firm size growth rate, gender, education dummies, industry dummies, town dummies, occupation dummies and year dummies.

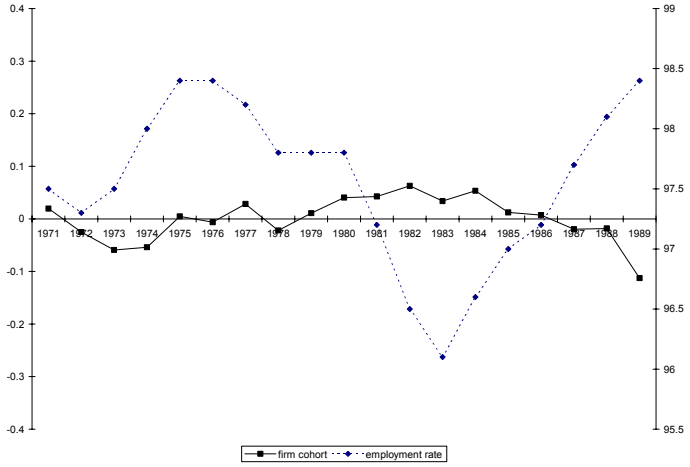
Figure 7 Cohort Effects in Promotion Rates (Catch-Up)
(dependent variable=number of promotions in current occupation)



(a) Labor Market Cohort



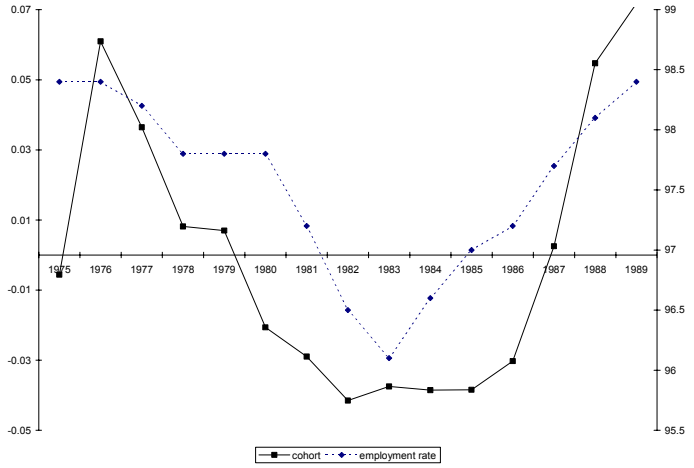
(b) Occupation Cohort



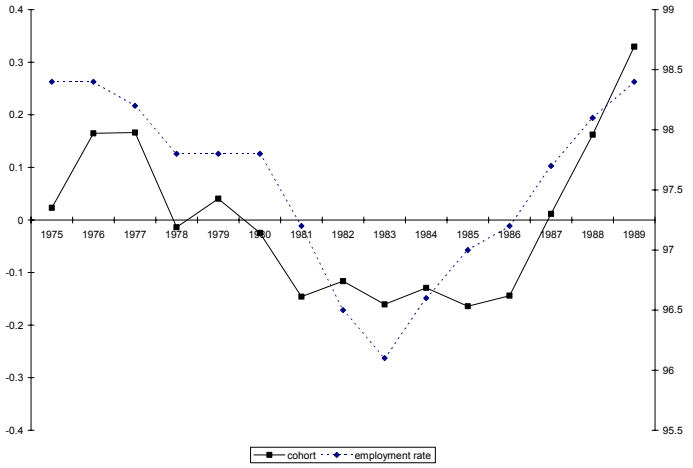
(c) Firm Cohort

Note: The figure displays the employment rate (=1-unemployment rate) and the linear de-trended coefficients of firm starting year dummies in the rank regression. The dependent variable is the number of promotions in the current occupation. The regression includes age, labor market experience, firm tenure, occupation tenure, labor market starting year dummies, occupation starting year dummies, firm starting year dummies, firm size, firm size growth rate, gender, education dummies, industry dummies, town dummies, occupation dummies and year dummies.

Figure 8 Workers who Started at Occupation 800 (Marketing) Rank 5



(a) Cohort Effect in Wages
(dependent variable=log(hourly real wage)



(b) Cohort Effect in Promotion Rates
(dependent variable=number of promotions in current occupation)

Note: The figures show the cohort effects in wages and promotion rates for those who have started the career at occupation 800 rank 6 and have not changed either firm nor occupation since. There are 10,524 of these workers in our sample (= big firms in 1986-1989)