The Firm Size Effect: fact or artifact?*

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Abstract

The size-wage effect is well documented in the empirical literature, and typical attempts of explanation center on the supply side, using variations of the human capital approach, perhaps combined with institutional theories. With conclusive evidence of its source yet to emerge, an alternative approach with interesting prospects attempts to give the demand side a more active part to play. Interpreting jobs as tasks, potentially firm-specific and organized in hierarchies, the optimal position for an individual can be assumed to be a function of ability and human capital, while the wage for a specific task is primarily decided by its value for the firm. Then, the role played by human capital changes, its effect being only indirect on wages, and the issue of how the existence of task structures, or career ladders, affect wages becomes paramount. Using data with detailed information about job content and structure, evidence of a natural positive correlation between size and structure is found. Combined with the reasonable assumption of a positive correlation between the position of tasks in the hierarchy and the wage, a size effect may very well come out positive and significant if we fail to control for it, making it an artifact of the data rather than an accurate description of the world.

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Contents

1 Introduction

With no recognizable agent to explain it, the size-wage effect, that is the well documented positive relationship between the wage level and employer size, remains a puzzle despite numerous attempts to explain it. The typical approach, combining neoclassical and institutional elements, often resulting in the specification of a variation of the Mincer equation, has yet not managed to stand up to the test put up by data and yield conclusive evidence about the source.

The theory of human capital, its formation and effects, figure prominently in the size-wage effect literature, and as a rule focus is set on the supply side of labor. This is probably partly an effect of the lack of data collected with the specific purpose of investigating this effect, seriously limiting the possibilities of in-depth investigation. However, the limited discussion of effects originating from the supply side may very well have resulted in an erroneous interpretation of results.

Borrowing the interpretation of a job as a collection of tasks, with the price or value of completed tasks being the primary determinant of the wage, the role of human capital in the labor market may need to be re-evaluated slightly. Then, human capital, be it endowed or acquired, only indicates what kind of tasks the potential employee could do, but as this is not necessarily known by the employer, it need not be what the employee actually does. This weakens the direct link between human capital and the wage, where human capital now only operates through the assigned tasks. On the supply side, tasks may be organized in a hierarchical structure, defining career ladders. If such a structure is in anyway defined in terms of extent of managerial responsibilities, then a positive relationship may be induced for the simple reason that certain kinds of tasks, at the top of the ladder, may naturally occur only in large firms. Thus, failing to take proper account of an existing hierarchy may therefore lead to the erroneous conclusion of an existing size-wage effect. This issue is addressed using a unique, extensive, and nearly exhaustive data-set of Swedish white-collar workers.

The organization of this paper is as follows. In Section 2 the employer size-wage effect is discussed. Past evidence and common explanations offered are briefly reviewed in Section 2.1, while Section 2.2 argues for a job centered approach when investigating the primary wage determinants. The objective of Section 3 is to convert these ideas into an empirical strategy, aimed at elucidating the existence and nature of the size effect. A basic model is specified in Section 3.1, where the problem of selecting appropriate definitions of the wage and size are examined. In Section 3.2 the available data is described, and in Section 3.3, its limitations and unique features result in suggested three stage analysis, with results presented in Section 4. The results from the first stage are presented in Section 4.1, where the basic wage equation is fit disregarding all available job structure information, a design which mimics a fairly typical situation with respect to data detail. The results from wage equations fit per occupation are presented and discussed in Section 4.2. This corresponds to a wage equation with occupational dummies, which do occur in the empirical literature, and a full two-way interaction specification, which to our knowledge never has been done before, the reason for this being data limitations. Operating at the very limit of possible data disaggregation, in Section 4.3, the results from within occupation per level of difficulty wage equations are summarized. An attempt to summarize and explain the findings can be found in Section 5.

2 The employer size-wage effect

2.1 Previous findings

The positive relationship between the wage level and employer size, known as the size-wage effect, is well documented in the empirical literature. With no apparent agent to explain the size effect, its existence has been contested on a fundamental level by some, while made it officially a puzzle to explain for others. The attempts to justify its existence have resulted in several explanations being offered in the literature, Brown & Medoff (1989) dividing them into two main categories; the neoclassical and institutional explanations.

Neoclassical explanations include the *labor quality hypothesis*, where a positive correlation between firm size and capital intensity coupled with a capital-skill complementarity could yield the desired effect, *the efficiency wage explanation,* where large firms face increased monitoring problems and rewarding workers with a higher wage would increase the alternative cost of being fired, and the *theory of compensating wage differentials*, where large firms have to pay a premium to compensate workers for unattractive work conditions that might be associated with working there.

Examples of institutional oriented explanations include *the monopoly power explanation,* where large firms may earn excess profits due to some degree of market power and for some reason decides to share the rents, and the *unionization avoidance hypothesis*, where large nonunion firms will pay higher wages in order to insure, in a sense, against unionization.

When these theories have been put to the test, the size effect has resisted numerous attempts of explanation, and has proven to be highly persistent, even after adding various controls for general location factors, for example industry, occupation, and union attendance, and individual specific factors, such as sex, race, and age. Thus, a large body of empirical evidence has been accumulated over time, primarily based on U.S. data. For a comprehensive review of these results, see Oi & Idson (1999) and references therein. For the nordic countries in general, and Sweden in particular, Albæk, Arai, Asplund, Barth & Madsen (1998) reports similar results. Arai (1999), using Swedish linked employer-employee data-set, finds a positive and significant effect, even after controlling for firm specific factors, such as the capital-labor ratio and firm profits.

2.2 The primary wage determinant

Differences in skills and productivity can roughly be classified as due to inherited or acquired characteristics. In the framework of the human capital theory the acquirement, or investment, in human capital is the point of departure for studying wage differentials. Workers may differ in knowledge and experiences, both general and specific, implying variable productivity resulting in variable compensation. A standard tool for analyzing the return to observable investments of human capital is the Mincer equation, see for example Fallon & Verry (1988) for a formal derivation. Apart from individual specific differences, other factors that may prompt wage differentials can be traced back to differences between jobs and job content, where typical examples include degree of responsibility, employment security, and working environment. The theoretical framework for explaining wage differentials as a function of differences in working conditions is deeply rooted in the history of economic thought, originating in the theory of compensating wage differentials by Adam Smith.

The technique used to fuse the two aspects can simply be described as a combination of the human capital framework with inclusion of institutional explanations, involving a Mincer equation extended with state variables. While this approach extends the analysis of wage differentials over various dimensions, i.e. between industries, gender, private- and public sector, family circumstances, and firm-size, the use of this framework implies that inherited characteristics and ability are often left out as unobservable latent variables. Though it is certainly true that observable human capital variables may capture some of the effects of the unobserved characteristics, turning away from methods centered on the individual, where the wage is determined by individual characteristics and controls, may provide new insights. Looking instead at the return paid for specific tasks performed by the workers offers particularly interesting alternatives.

The disregard of the demand side is a major weakness of the pure human capital approach. Arguing that the amount of human capital available only says something about what an individual ought to or could potentially be doing, it defines a capability set. The key word is *potential*, as the outcome on the labor market is not unilaterally decided by the individual supplying labor, rather it will be an intersection between the capability set and this individual specific opportunity set. While the limits of such an opportunity set may very well depend on the human capital of an individual, an important dimension is defined by the demand side, where firms can be interpreted as filling this opportunity set with jobs, each with a wage attached to it. Thus, depending on circumstances, where the worker lands need not be at the limit of his or hers capabilities. Assuming prudent hiring policies it is more likely that individuals will have to advance towards the best match of skills and work definition from below, at a pace defined by the rate at which their true potential is revealed and further human capital is acquired. A result of this is a weaker correlation between human capital and wages in the short run, which may be further weakened if jobs are defined as collections of tasks, or job-tasks. Assuming that jobs offered by any firm are mainly defined as a collections of tasks it wishes to have performed, the main determinant of the wage attached should be the price or value of having them completed. Within the firm, the main determinant of the price, hence the wage, is the importance of the tasks to the firm, though environmental factors, such as location, degree of competition and availability of inputs, may result in different wages for apparently the same tasks when comparing firms.

By defining the job by content, and not the salary category, we argue that this may control for inherited and acquired characteristics that are required to perform the specific job assignment, as well as the problems of limited information, undisclosed worker ability, and match quality. In this alternative way of wage determination, ability, experience, and other human capital, coupled with the present opportunities presumably decides the job-task held by an individual, with the wage received being only indirectly dependent of these characteristics. Then, any variation in the wage between individuals with the same job-task should depend on other characteristics, such as regional- and industry-specific differences, market power in sales or production, or differences in size of the firms. Within this framework the positive effect of firm size can be analyzed, and questioned.

3 Towards a job centered approach

3.1 The model specification

The standard approach of analyzing the employer size-wage relationship has been in the form of estimating a log-linear wage equation. By specifying the wage and employment size measures in logarithmic forms, the estimated size effect is interpreted as the constant elasticity of the wage measure, with respect to the size measure. A standard specification is

$$\ln W = X\beta + \beta_s \cdot \ln S \tag{1}$$

where W is the wage, S is the employer size, and X a set of explanatory variables, or controls, thought to affect the wage. These roughly divide into three categories, each representing different levels present in the problem. Thus, on the individual level, a first category includes standard human capital variables, for example schooling, experience, seniority, race, and gender. On the firm level, a second category includes variables characterizing firms, for example the capital-labor ratio, turnover, and profits. A third level includes various geographical and industry indicators, which may be interpreted as general spatial variables. Obviously, the composition of X depends on the available data, creating some interpretational difficulties when making comparisons across studies. This is a minor problem compared to that of defining measures of the wage and size. With interest centered on the effect of size S on wages W, it is imperative to agree on definitions for these magnitudes.

For the size, two candidates measures dominate the literature. The first is the aggregated measure of total firm size, implying disregard of the number of establishments, where small single-establishment firms are compared to large multi-establishment companies. The second is the local establishment- or plant-size measure. It is not evidently clear which of the two measure that is the most appropriate, and the possibility that an existing size effect is too complex to capture with either alone should not be neglected. That the effect is present at both levels is concluded in Brown & Medoff (1989).

For the wage variable the situation is even more complicated. Since the wage may consist of several wage elements, for example a fix. baseline wage, commission, bonus, fringe benefits, and overtime compensation, several combinations are available. The dominating choice in the literature is the baseline wage per hour, however Brown & Medoff (1989) finds that the size effect is stronger when the wage measure includes fringe benefits. With results depending on the definition, great care has to be exercised, though the possible choices are often limited by the details of the available data.

3.2 Data

The data we will use were collected and compiled by the Central Confederation of Employers (SAF), from their database on wage statistics, assembled from firm-level personnel records. It contains information for all white-collar workers in every industry in the private sector within the SAF domain, with the exception of the insurance and banking sector. For the year 1990, information was reported the second quarter for 391 997 individual white-collar workers.

The establishment characteristics recorded in the data include an industry code, firm code and size (the total number of employees), establishment size (number of employees at establishment level within the firm), the region and area within region. For each employee the data includes information on gender, age, union status, method of wage payment, and stipulated contract hours, in hourly units. The wage payment is reported componentwise as baseline wage, overtime compensation, bonuses and fringe benefits.

A detailed description of job contents is also reported, using a four-digit code. This so-called BNT occupational code system consists of 51 broad occupational groups, see Appendix A on page 24 for a detailed description. Within each group a distinction is made with respect to the difficulty in the job, with a maximum span of 7 different levels, covering 271 positions altogether in the period. We shall refer to this job content information as occupational codes, although it might also be described as job titles. This type of occupational code can be seen as an occupational opportunity structure of the hierarchy within and between firms, or establishments.

The data have been used for inputs in the annual wage negotiations, and should be very reliable compared to the information from standard sample surveys, since it is taken from personnel records rather than self-reports.

3.3 The empirical strategy

Arguing as in Section 2.2, that the work-task currently held by any individual within a job hierarchy should measure the extent to which acquired skills has been accumulated by the individual and innate ability has been revealed to the employer, what the data may lack in detail with respect to human capital and other variables, it more than makes up with a detailed job classification. Though several attempts to explain the size effect have been made including occupational and job hierarchy variables, the exhaustive nature of the available material offers unique possibilities. When possible, controls for occupations have typically been introduced as dummy variables, with an in-depth analysis of job and job structure effects absent. Why observations and demand side stylized facts have not been fully exploited in previous research can partly be attributed to data limitations, a notion supported in Lazear (1992). However, the material available includes in principle all employees in every firm holding occupations at some level per establishment. This allows the disaggregation of the data into subsets, each associated with a particular occupation, and the estimation of separate wage equations for each occupation. Even though more refined statistical methods could be used, due to the massive amount of data simple statistical tools are used, aimed towards the description of general systematic features present, rather than the modelling details.

Before attempting to measure the size-wage effect, an important question discussed briefly in Section 3.1 is how to measure the quantities of interest. The available data includes four distinct wage components, normal pay w_n, commission w_c, bonus w_b, and fringe benefits w_f, allowing various definitions of the dependent variable in a wage equation. Further, when matched with the corresponding data collected on blue collar workers, four size measures are available; the number of white collar workers employed at establishment i in firm j, n_{ij}^w, the total number of white collar workers employed by firm j, n_j^w, and the corresponding quantities for blue collar workers, n_{ij}^b and n_{ij}^b. With the data including a large number of individuals receiving a significant part of their pay as commission, the primary choice for the wage measure is $w_n + w_c$, to avoid unnecessary data attrition. For the size measure, the choice falls on n_{ij}^w, to avoid inducing any errors when matching the two data sets, arguing also that it could be expected to have the clearest effect being the measure which in a sense is closest.

The analysis is performed in three stages. In a first stage, a typical wage equation is estimated without any occupational related controls, limiting controls to sex, age and its square, and a dummy for individuals hired on a part time basis. This is done to ensure that any results in latter stages does not depend on features of the available data, and to get a baseline estimate of the size effect, mimicing the analysis which is typically possible. In a second stage, the data is disaggregated into 51 wide occupational definitions, all listed in Appendix A on page 24. The resulting subsets vary considerably in size, from several hundred for the smallest to over 60 thousand for the largest, though typically the size is counted in the thousands. Though this step may shed some light on the importance of the occupation on a size effect, it is an intermediary step towards the third stage, where disaggregation into levels within the occupations is performed. Though operating at the limit of feasible disaggregation, 266 levels are adequately represented, and separate equations are estimated for each of them.

4 Results

4.1 A standard plant size effect

To assure that any contrary results obtained with respect to size effects are not a feature of the data used, wage equations without any occupational controls are estimated, all including age, age squared, a part time dummy, and gender as explanatory variables, with wage defined as either w_n, $w_n + w_c$, or $w_n + w_c + w_b + w_f$, and size defined as either n_{ij}^w, n_j^w, $n_{ij}^w + n_{ij}^b$, or $n_j^w + n_j^b$.

The results for $w_n + w_c$ are illustrated in Table 1. Regardless of the size definition, the average effect comes out positive, albeit decreasing; the latter being a natural effect of the widening definition of size. All other coefficients are estimated with the expected sign and seemingly unaffected by the definition of size. Repeating the estimation exercise for other definitions of the wage yields similar results.

[Table 1 about here]

The results from table 1 points towards a positive wage-size elasticity, ranging from 0.007 to 0.018 depending on the definition of the size measure.

Though a direct comparison may not be entirely appropriate, these results are in general agreement with other estimates offered in the literature. For example, le Grand (1989) estimates a plant size elasticity of 0.015, when controlling for individual characteristics and using data from the Swedish level of living Survey (LNU81), while Albæk et al. (1998) estimates the plant size elasticity to 0.016 for the year 1991, using 1322 observations from LNU91 matched with the Swedish Establishment survey (APU). Comparing these results with the estimates presented in table 1, the conclusion drawn is that they do not differ in any obvious way.

In the following inquiries into the nature of the size effect, the presentation of results will be limited to the definition of the wage as $w_n + w_c$ and size as n_{ij}^w; see the brief discussion in Section 3.3.

4.2 Introducing wide occupational definitions

In a second step, 51 subsamples each corresponding to wide occupational definitions are created, and separate wage equations estimated for each of them. Focusing on the size effect, the estimates obtained are illustrated in Figure 1. Obviously, what kind of job is held by an individual matters, in the sense that the estimated size effect varies, but on average it is slightly smaller than the one estimated in Section 4.1, the mean size effect dropping with about 15%, compared to the overall result in Table 1. However, observing the two markedly different estimates in the right tail, using instead the median the drop is nearly 25%. A particularly interesting observation is the fact that 20% of the estimates are actually negative, which may be interpreted as a sign of the diluting effect of the occupational control.

[Figure 1 about here]

Though difficult to interpret jointly, conducting tests of *zero* size effect against a two sided alternative, we observe a dependence between outcome and the sign of the estimate. While there still seems to be evidence of a positive size effect, the results of these tests, summarized in 2, show how occupation may have a critical impact on the results.

[Table 2 about here]

While casting a slight shadow, the occupational control does fail to give decisive evidence against a positive size effect. If the effect is indeed an artifact, due to some data feature or structural detail, this may be interpreted as evidence of this feature also operating at the occupational level, albeit not as conclusively.

4.3 The effects of occupational specific hierarchies

With the definitions of occupations used in Section 4.2 being rather crude, the estimated size effects offered slight evidence, if any, against the hypothesis of a positive correlation. However, after further disaggregation of the 51 occupations into levels, resulting in 266 subsets with adequate representation for estimation of separate wage equations, the picture becomes much more fragmented.

[Figure 2 about here]

Concentrating yet again on the size effects, their estimates illustrated in Figure 2, the distribution has shifted to the left, with a majority of negative size effects. Due to one extreme positive effect the mean size effect is still positive, at 0.00171, however the median is negative, at -0.00260, with the majority of observations clustering around *zero*. The individual tests now give over 40% of the estimates being insignificant, while the negative sign dominates slightly among the significant effects.

A closer study of the test results for each level reveals an interesting pattern, illustrated in Table 3. There is some evidence of a dependence, with a relatively higher presence of negative effects at lower levels, smoothly converted into a higher relative presence of positive effects at higher levels.

[Table 3 about here]

Assembling the levels associated to a given occupation, this pattern is present if not consistently at least to a recognizable degree in numerous cases, illustrated in Figure 3 for the seven levels associated with occupation 600 labeled *personnel administration*. In this figure, the corresponding estimated regression equations for each level are evaluated at the mode of the observed explanatory variables except size, to generate predicted wages at various values of firm size. To put these lines into perspective, they are plotted together with the observed combinations of wages and sizes. Other frequent patterns that emerge using this procedure, are mostly negative, mostly positive, and mostly insignificant.

[Figure 3 about here]

When collecting occupations into families an indication of another kind of dependence may be discerned, where occupations with negative effects dominating their levels seem to cluster together, and correspondingly for occupations with positive effects. The significance of this is unclear. Interpreting the results as a whole, these results give testimony against a consistent and one sided size effect. If there exists a size effect the evidence points at a much more refined structure.

5 Conclusion

Examining the results in Section 4, and in particular the differences observed between results in Sections 4.2-4.3, two tentative conclusions drawn are that the occupation may matter, though perhaps not immediately and not in an obvious manner, and that the existence and control of any occupational hierarchy has a profound impact, to the extent that the size effect, if it exists, is not necessarily positive.

If we are not willing to abandon the idea of an existing size effect, the problem remaining is to find a plausible explanation for the observed size effect pattern. To that end, matching and tournament theories may offer some important insights. For instance, large firms may use lower wages at lower levels as a combined screening and monitoring device. Screening to make certain that higher level jobs are filled with highly skilled and specialized workers, who are those that may be willing to choose a lower wage at a low level job, for the possibility of earning a wage premium at a high level job in the future. Monitoring in the sense that workers who do not advance, because they do not show the required aptitude, but for some reason choose to stay, will continue contributing to the premium paid to those who do advance.

A more speculative approach available is to theorize about any existing structural differences between small and large firms, and the effect these may have on the wage profile. For instance, the positive effect at higher levels may be attributed to the possibly capped productivity of highly skilled and specialized workers at small establishments. Simply put, the small firm may not need or be able to fully utilize such a worker. Conversely, small firms may want to hedge against the risks associated with employee-flight by hiring and paying a premium for workers with more general skills, giving rise to the negative relationship at low levels.

Further exploration of the structure imposed on wages by occupational hierarchies reveals how a size effect may be just an invention. In Figure 4, the jitter plots of establishment size against levels for occupation 600, personnel administration, illustrate a structure that may be found in virtually every occupation. With levels often defined in terms of the extent of managerial and budgetary responsibilities attached to the job title, the availability of high level jobs at small firms is severely limited by construction; there may not be enough employees to manage or the budget to be responsible for may be too small. This creates a positive correlation between size and levels, which can be further amplified by the relative scarcity of low level jobs at large establishments. Hence, combined with the reasonable assumption of a positive correlation between the level and the wage, a size effect may very well come out positive and significant if we fail to control for the existence of hierarchies, making it an artifact of the data rather than an accurate description of the world.

[Figure 4 about here]

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Table 1: Estimated size effects for various size measures, wage defined $w_n + w_c$.

Model:	(1).	(2).	(3).	(4).
Dependent variable: log wage.				
α	3.194	3.206	3.229	3.237
	(643.818)	(640.421)	(645.732)	(642.792)
β_a	0.058	0.058	0.058	0.058
	(241.323)	(240.703)	(239.284)	(239.359)
β_{a^2}	-0.001	-0.001	-0.001	-0.001
	(-214.282)	(-213.809)	(-212.673)	(-212.752)
β_{pt}	-0.069	-0.071	-0.072	-0.072
	(-55.837)	(-56.570)	(-57.280)	(-57.599)
β_s	-0.221	-0.221	-0.222	-0.223
	(-249.576)	(-249.002)	(-249.210)	(-249.440)
β_{s1}^{1}	0.018			
	(89.041)			
β_{s2}^{2}		0.013		
		(66.740)		
β_{s3}^{3}			0.010	
			(48.982)	
β_{s4}^{4}				0.007
				(36.018)
R^2	0.356	0.351	0.347	0.345

[1]Size defined as log number of white collar workers in est.
[2]Size defined as log number of white collar workers at firm.
[3]Size defined as log total number of workers in est.
[4]Size defined as log total number of workers at firm.

Figure 1 Distribution of occupation specific size effects, β_{s1}, with wage defined as $w_n + w_c$ and size defined as n_{ij}^w; histogram and density estimate using the Epanechnikov kernel. The vertical line shows the aggregate estimate from the corresponding column in Table 1.

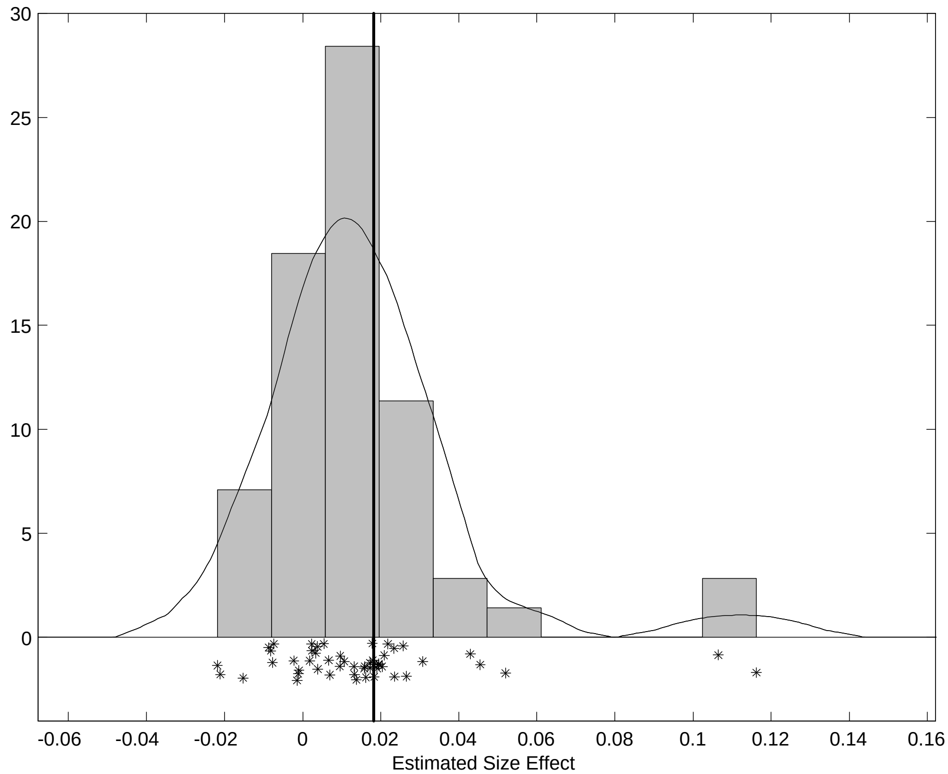


Table 2: Testing the occupation specific wage-size effect; summary, $H_0 : \beta_{s1} = 0$, against a two-sided alternative. Wage defined as $w_n + w_c$ and size defined as n_{ij}^{w}. The $\widehat{\beta}_{s1}$ refer to the observed sign of the estimated parameter.

	SIGNIFICANT*	INSIGNIFICANT
$\widehat{\beta}_{s1} > 0$	36	4
$\widehat{\beta}_{s1} < 0$	5	6

*Significant on the 5% level.

Figure 2 Distribution of occupation level specific size effects, β_{s1}, with wage defined as $w_n + w_c$ and size defined as n_{ij}^w; histogram and density estimate using the Epanechnikov kernel. The vertical line shows the aggregate estimate from the corresponding column in Table 1.

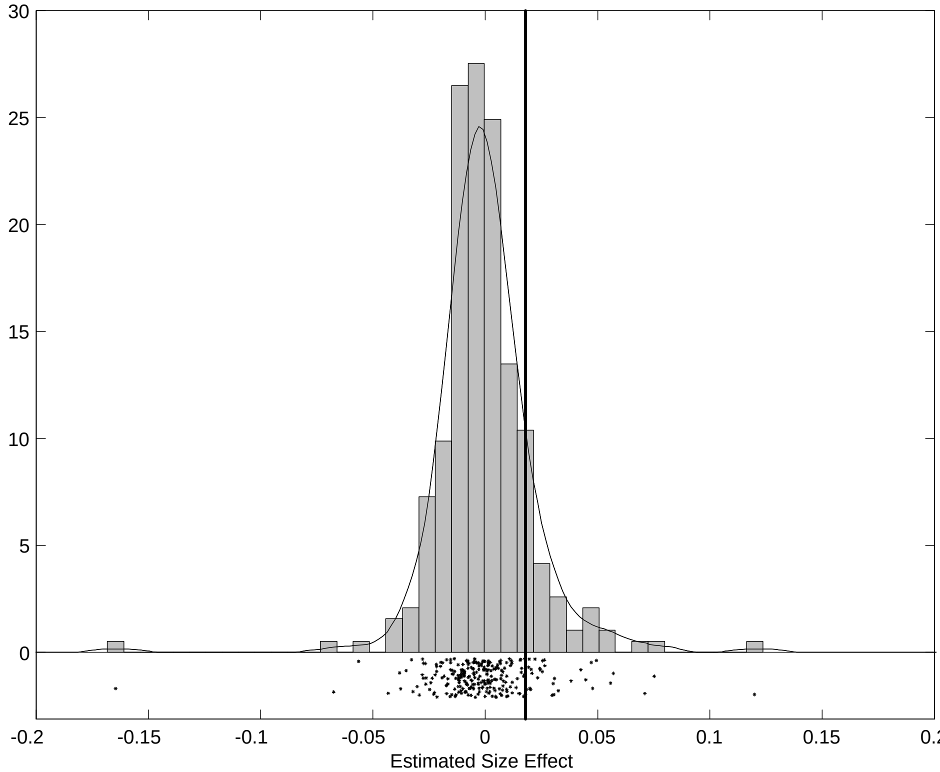


Table 3: Testing the job specific wage-size effect; summary and by level, $H_0 : \beta_{s1} = 0$, against a two-sided alternative. Wage defined as $w_n + w_c$ and size defined as n_{ij}^w. The $\widehat{\beta}_{s1}$ refer to the observed sign of the estimated parameter.

All	Significant*	Insignificant
$\widehat{\beta}_{s1} > 0$	62	52
$\widehat{\beta}_{s1} < 0$	89	63
Level 1		
$\widehat{\beta}_{s1} > 0$	0	4
$\widehat{\beta}_{s1} < 0$	11	6
Level 2		
$\widehat{\beta}_{s1} > 0$	7	6
$\widehat{\beta}_{s1} < 0$	19	11
Level 3		
$\widehat{\beta}_{s1} > 0$	11	6
$\widehat{\beta}_{s1} < 0$	22	9
Level 4		
$\widehat{\beta}_{s1} > 0$	14	7
$\widehat{\beta}_{s1} < 0$	23	5
Level 5		
$\widehat{\beta}_{s1} > 0$	14	6
$\widehat{\beta}_{s1} < 0$	13	10
Level 6		
$\widehat{\beta}_{s1} > 0$	9	17
$\widehat{\beta}_{s1} < 0$	1	13
Level 7		
$\widehat{\beta}_{s1} > 0$	7	6
$\widehat{\beta}_{s1} < 0$	0	9

*Significant on the 5% level.

Figure 3 The observed combinations of wages and sizes for job content 600, personnel administration, and the predicted wages as a function of firm size, evaluated at the mode of all other variables, by level. The thick reference line corresponds to predicted values of the estimated equation for personnel administration in Section 4.2, calculated analoguously.

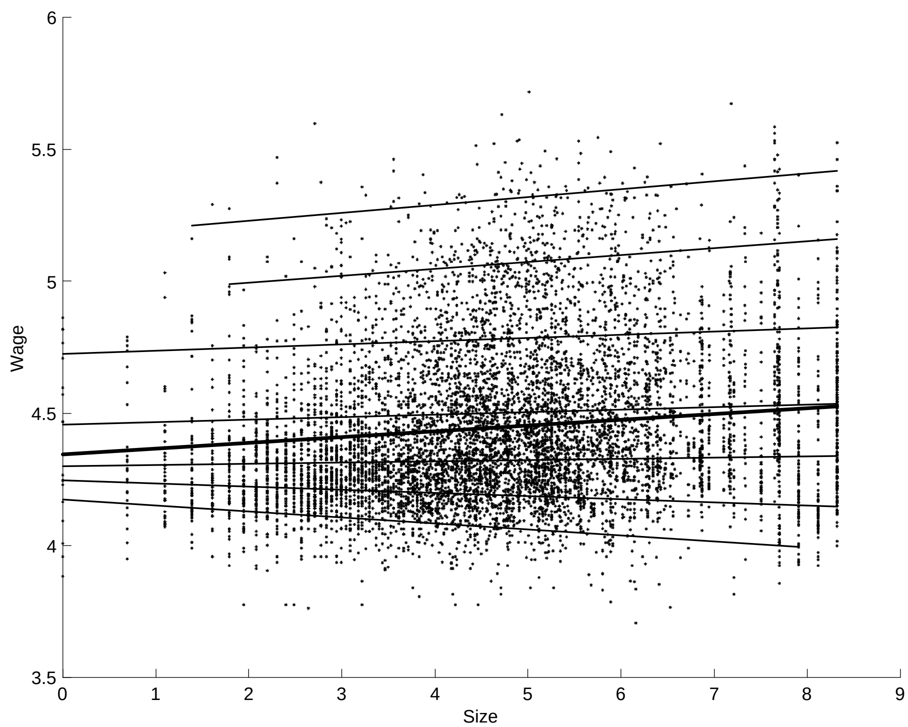
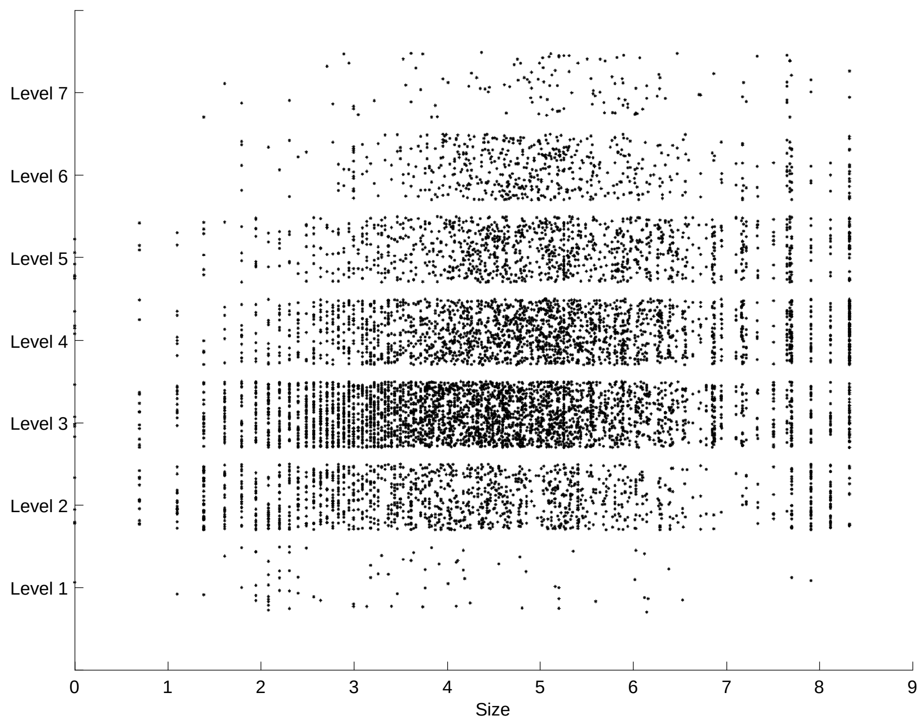


Figure 4 Jitter plots of establishment size by level, job content 600, personnel administration. Notice the scarcity of high level jobs at smaller establishments, resulting in a weak but significant positive correlation between size and levels.



A Description BNT

The BNT code was developed in 1955 and has been revised several times since; Arbetsgivareföreningen (1982).The official purpose for its use is keeping records of wage related statistics, and not to use as direct inputs in the wage setting process (individual, or occupational). See page 204 in SOU (1993).

Table 4: Position nomenclature, white collar workers.

Family	**Code**	**Levels**	Explanation (Job Content)
0			ADMINISTRATIVE WORK
	020	7	General analytical work
	025	6	Secretarial work
	060	6	Efficiency improvement and development
	070	6	Applied data processing: system analysis and programming
	075	7	Applied data processing: operation
	076	4	Key punching
1			PRODUCTION MANAGEMENT
	100	4	Local administration of plants and branches
	110	5	Management: production, transportation and maintenance
	120	5	Supervision production, transportation and maintenance
	140	5	Supervision, building and construction
	160	4	Administration, supervision within forestry
2			RESEARCH AND DEVELOPMENT
	200	6	Mathematical work
	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

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Family	**Code**	**Levels**	Explanation
4			Technical methodology, etc
	400	6	Production engineering
	410	7	Production planning
	415	6	Traffic and transportation planning
	440	7	Quality control
	470	6	Tecnical service
	480	5	Industrial preventive health care, fire protection, and security
5			Com., library and archival work
	550	5	Information work
	560	5	Editorial work and publishing
	570	4	Editorial work, technical information
	590	6	Library, archives and documentation
6			Personnel work
	600	7	Personnel administration, general
	620	6	Educational planning
	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, etc
	835	3	Customer service
	840	5	Tender calculation
	850	5	Order processing
	855	4	Internal processing of customer requests
	860	5	Advertising
	870	7	Buying
	880	6	Management of inventory and sales
	890	6	Shipping and freight services

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Family	**Code**	**Levels**	Explanation
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