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The Exit of Pharmacia and Regional Growth

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Abstract: In this paper we ask whether the withdrawal of a major employer (Pharmacia) from a region in Sweden (Uppsala) has had a negative effect on employment growth. We explore the possibility that the exit of Pharmacia may not have had a negative effect on the total employment in the region. It might be the case that new innovative resources with economic potential have been released due to the withdrawal leading to new firm formation and expansion of existing firms. We find no evidence that the withdrawal has led to a negative effect on employment growth in the region.

Key words: Exit, Regional growth, Start-ups, Entry

1. INTRODUCTION

Until 1995, Pharmacia AB was a Swedish-based company. However, in 1995, Pharmacia & Upjohn was formed through the merger of Pharmacia AB and Upjohn Company (PHARMACIA HOMEPAGE, 2002). The consequence has been a partial withdrawal of Pharmacia from the Uppsala region. In this paper this is referred to as the exit or withdrawal of Pharmacia. Due to the merger most of the management activities, ranging from supply, R&D and marketing, moved to the US based headquarters. Left in Sweden was mainly a big pharmaceutical production site and an equipment supplier, Pharmacia Biotech. About 200 employees lost their jobs in Pharmacia during the withdrawal. However, Pharmacia Biotech merged with British Amersham in 1997 (AMERSHAM PRESS RELEASE, 1997). In 2000, Pharmacia & Upjohn and the Monsanto Company formed the new company Pharmacia Corporation with its headquarters in the US, and in the spring of 2002 the American company Pfizer placed a bid on Pharmacia Corporation. In December of 2002 the Pharmacia Corporation announced that its shareholders voted in favour for the proposed merger (PHARMACIA PRESS RELESE, 2002).

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In 1996 the Chamber of Commerce for Uppsala County (UPPSVENSKA HANDELSKAMMAREN, 1996) surveyed the number of company start-ups related to the “exit of Pharmacia” in 1995. This was in response to political worries about a possible industrial decline in the Uppsala region due to the cutback and relocation of employees. Recently, however, Uppsala has been the focus of media attention as a new bio-tech boom area, contrary to earlier concerns it appears to be that the withdrawal of Pharmacia has released people with competence and skills that establish new firms.

From this perspective the reorganization of Pharmacia and the entire Uppsala region in fact serves, as an interesting illustration of SCHUMPETER'S, 1942, creative-destruction process.

It may be the case that the exit of a firm puts a dynamic process in motion that generates new and expanding firms that compensate for the initial employment loss, known as the creative destruction process (SCHUMPETER, 1942). Hence, exit does not necessarily have to be negative if it induces and releases resources for new firms formation and expansion of existing firms. It can therefore be concluded that the exit of firms will not necessarily have a negative effect on employment¹.

Thus, in the case of Pharmacia one may expect, contrary to what many would believe, to find that the regional-growth has not been affected in form of a decreased growth in employment as a consequence of Pharmacia's partial withdrawal from the Uppsala region. For instance, ARMINGTON and ACS, 2002, shows that regions with highly educated people (as in Uppsala) are much more likely to have a higher percentage of start-ups. The region also has a developed network² that can help enhance the entrepreneurial activity in the region. There are several researchers that have studied the importance of location for growth. GLASMEIER, 1986, shows that the high-tech firms might be constrained to a location by their need for specific labour skills. DAVIDSSON *et al.*, 2002, on the other hand, find little evidence that location or region plays an important role for growth. However, GRAY and PARKER, 1998, have studied the regional development of the US biotechnology and pharmaceutical industries and they found that firms in emerging industries follows a multifaceted location pattern, some emerge in new regions and some in mature regions that has a rich economic mix such as Uppsala.

¹ There are also studies that have shown that unemployment is positively related to new firm formation i.e. start-ups (STOREY, 1991). However, AUDRETSCH and FRITSCH, 1994, found that unemployment tends to depress firm formation.

² See for instance WALUSZEWSKI, 2002.

This can be expressed as the following hypothesis:

H_0 : The exit of Pharmacia in Uppsala has had a negative effect on growth.

H_1 : The exit of Pharmacia in Uppsala has had no or a positive effect on growth.

The H_0 hypothesis is expected to be rejected, we assume that the exit of Pharmacia from Uppsala has had no, or a positive effect on growth.

The paper is organised as follows. In the next section the data is described. Before presenting the econometric model we explore our data. Thereafter the econometric results are shown. The paper ends with a summary and conclusions.

2. THE DATA

Statistics Sweden (*Statistiska Centralbyrån*, SCB) compiles data on the number of firms, establishments and employment in different industries. Until 1993, data were classified according to The Swedish Industrial Classification System established in 1969 (SNI69), which corresponds to the International Standard Industrial Classification of All Economic Activities (ISIC) of the United Nations. However, ISIC is not used by the European Union, and therefore Sweden changed its classification system in 1993 to SNI92. SNI92 is the Swedish counterpart to the industrial classification system used in the European Union, *Nomenclature Générale Activités Economiques dans les Communautés Européennes* (NACE)³ (STATISTICS SWEDEN, 1992).

The econometric analysis is based on a set of data on establishments compiled by Statistics Sweden from the Central Register of Firms and Establishments (*Centrala Företags- och Arbetsställeregistret*, CFAR). CFAR covers all firms and establishments (sizes, industries, legal forms etc.) in Sweden. A firm can have many establishments.

Whether or not one should use firm or establishment data for the econometric analysis depends on the stressed question. If one is concerned with a regional allocation problem, e.g. if one

³ Both SNI92 and SNI69 are an activity-based industry classification, which means that the units of production (establishments and firms) are classified in industries according to the activity carried out in the production unit and not in terms of what is produced. Activity is defined as the process where different factors of production and combinations of these are used to produce goods and services. Hence, the firms and establishments are classified into industries according to the nature of the process of production (STATISTICS SWEDEN, 1992).

wishes to follow all activities in a municipality one should use establishment data since such data best represents physical activities and are well-defined geographically. Firms with production activities in Uppsala can be registered elsewhere and therefore establishment data is preferable for our analysis.

The data set covers 1993 to 2000 and contains yearly observations on individual establishments under the following SNI codes (STATISTICS SWEDEN, 1993-2001): 24410 and 24420 (pharmaceutical industry), 33101, 33102, 33200 and 33400 (the medical instruments and laboratory equipment), and 73103 (institutes for research and development in medical sciences).⁴ These codes are chosen because they represent a well-defined area where Pharmacia operates.

SCB is not allowed to give out the organisational numbers or the names of the establishments for confidentiality reasons. Therefore, SCB assigns a unique identification number to each establishment when founded that follows the establishment through its “life”.⁵ Hence, it is possible to identify and follow individual establishments, its local municipality and other categories collected by SCB, but not to identify the establishment by name or its organisational number.

The data set consists of cross-sectional time-series data, so-called panel data. The panel, however, is unbalanced, i.e., we do not have observations on all establishments for all years. This is so because of the dynamics of establishment entry and exit. For example, many of the establishments did not exist in the beginning of the period (see further Table 1). Hence, the establishment has been replaced by a missing value.

The data set can be described in a matrix; see Table 1. There are at most eight observations on each establishment (seven in the regressions). That is the case if the establishment has existed for all eight years. At a minimum, there is one observation on each establishment that is if the establishment was not entered until 2000 or only existed in 1993 and then exited. In total, the sample includes 13 049 establishments. Five different characteristics are identified for each observation (establishment).

⁴ In 1993 Sweden changed its classification system when adapting to the standards of the European Union. This makes it costly to follow establishments further back in time. 2000 is the latest year for which individual data are available on establishments.

⁵ It is worth underlining that all Swedish establishments are obliged to register by law. The Swedish statistics on establishments are therefore encompassing and covers *all* establishments in the *whole* economy. This makes the Swedish data more complete than most international data; see KIRCHHOFF, 1994.

Table 1. Different types of observations on establishments

Establishments	1993	1994	1995	1996	1997	1998	1999	2000
1								
2								
3								
.								
.								
.								
i)	X	X	X	X	X	X	X	X
ii)			X	X	X	X	X	X
iii)	X	X	X					
iv)		X	X	X				
v)								X
.								
.								
.								
N								

Source: Own table.

Note:

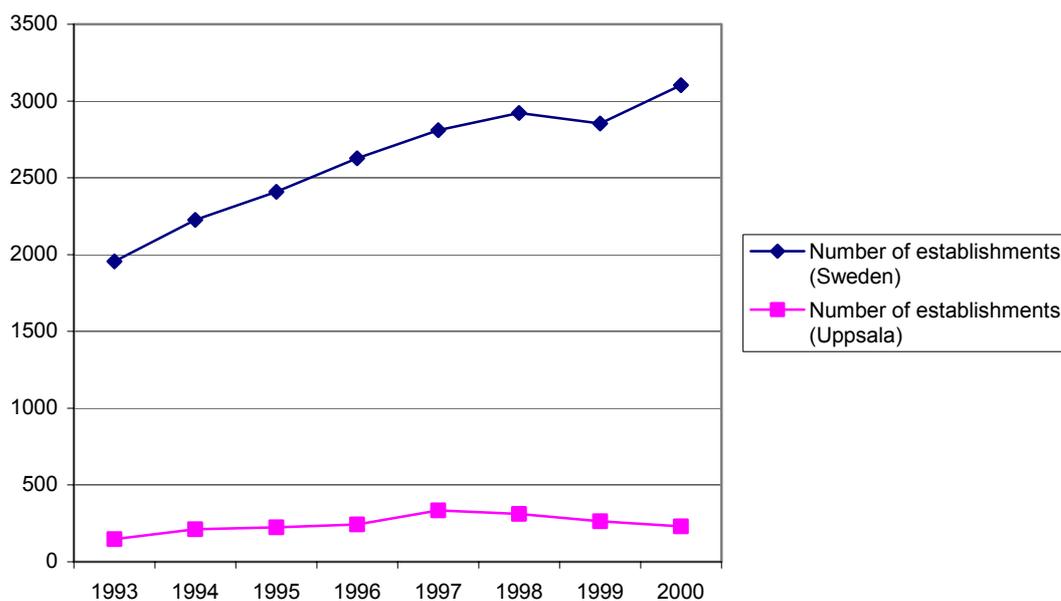
- i) Establishments existing the entire period.
- ii) Establishments started after 1993 and existing by the end of the period. The period before is given a missing value.
- iii) Establishments that existed in 1993 and exited during the period. The rest of the period is given a missing value.
- iv) Establishments entering after 1993 and exiting before 1998. A combination of ii) and iii).
- v) Establishments entering in 2000. The period before is given a missing value.

3. EXPLORING THE DATA

Before continuing with the econometric analysis, let us take a look at the number of establishments in Sweden in the pharmaceutical and medical technology industry, as we have defined it, and compare with the region of Uppsala, defined as the county.

As can be seen from Figure 1, the number of establishments in Sweden is growing over time. There was a small decline in 1999 but that was caught up with very quickly. Over the whole period from 1993 to 2000, the number of establishments was growing from 1 956 to 3 103. In the Uppsala region, there were more fluctuations. The number of establishment was growing until 1997 and then diminished, but never dipped under the 1996 level. Over the period, the number of establishments increased from 148 to 231.

Figure 1. Number of establishments in the pharmaceutical and medical technology industry, 1993-2000



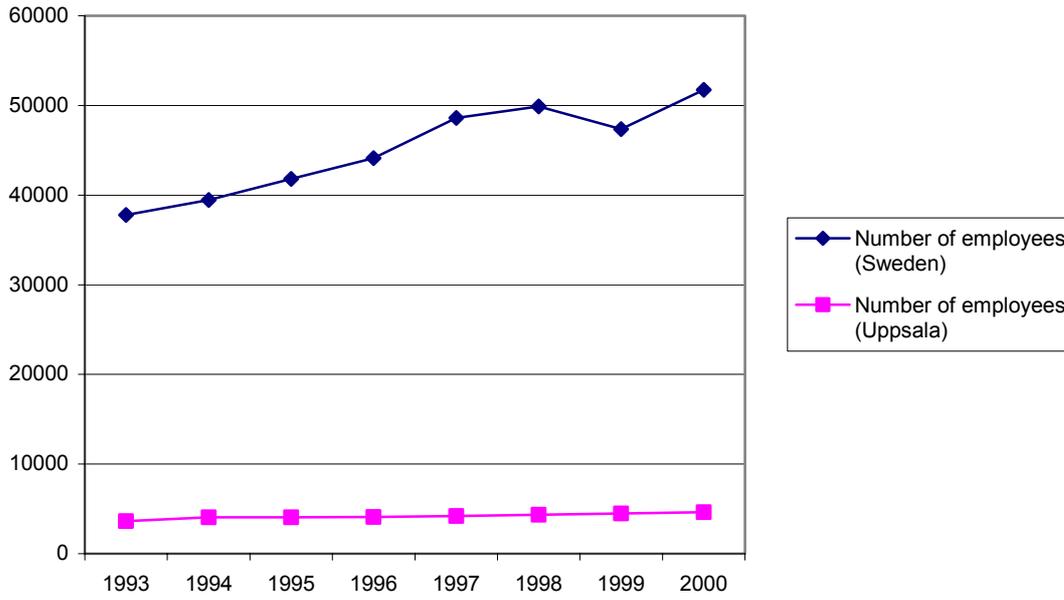
Source: Statistics Sweden and own calculations.

The pattern is somewhat different for the number of employees in the pharmaceutical and medical technology industry, our dependent variable in the econometric analysis. As can be seen in Figure 2, the number of employees in Sweden is constantly growing over the period 1993-2000, except for the fall in 1999, this was also registered in the number of establishments. Over the whole period the number of employees grew from 37 775 to 51 733.

In the Uppsala region, the number of employees grew from 3 633 to 4 627 employees between 1993-2000. Despite the withdrawal of Pharmacia in 1995, the number of employees increased from 4 047 to 4 098 between 1995-1996 in the Uppsala region.⁶

⁶ Both exits and entries have increased over the studied period.

Figure 2. Number of employees in the pharmaceutical and medical technology industry, 1993-2000



Source: Statistics Sweden and own calculations.

4. ECONOMETRIC ANALYSIS

To test the hypothesis outlined in the beginning of the paper the following econometric model can be used:

$$\begin{aligned}
 (1) \text{GROWTH}_{i,t} = & \beta_0 + \beta_{age} * \text{AGE}_{i,t-1} + \beta_{size} * \text{SIZE}_{i,t-1} + \beta_{age^2} * \text{AGE}_{i,t-1}^2 \\
 & + \beta_{size^2} * \text{SIZE}_{i,t-1}^2 + \beta_{owner} * \text{OWNER}_{i,t-1} + \beta_{Uppsala} * \text{UPPSALA}_i \\
 & + \beta_{interaction} * \text{INTERACTION}_i + \beta_d * Z^d + u_{i,t}
 \end{aligned}$$

where $\text{GROWTH}_{i,t}$, $\text{AGE}_{i,t-1}$ and $\text{SIZE}_{i,t-1}$ are vectors on the growth, age and size of pharmaceutical and medical technology establishments i at time t , $t-1$ and $t-1$, respectively. In addition to these variables, the model includes $\text{OWNER}_{i,t-1}$, which denotes ownership (private or government owner), UPPSALA_i , a dummy for the Uppsala region, INTERACTION_i , an interaction variable between UPPSALA_i and EXIT_i where EXIT_i is a dummy for the exit of Pharmacia and Z^d , which represents a vector with dummy variables; see below. $\text{AGE}_{i,t-1}^2$ and $\text{SIZE}_{i,t-1}^2$ are the quadratic forms of the age and size vectors. All of these variables are commonly used in empirical studies when available; see for instance EVANS, 1987a, 1987b.

β_0 is the intercept and $u_{i,t}$ the error term in the regression. The error term $u_{i,t}$ can be divided into an establishment-specific (μ_i), a time-specific (λ_t), and a random error term ($v_{i,t}$), see e.g. BALTAGI, 1999:

$$(2) u_{i,t} = \mu_i + \lambda_t + v_{i,t}$$

The variables are defined as follows:

Dependent variable:

$GROWTH_{i,t}$: The change in the number of employees in establishment i between time $t-1$ and t (percent). Note that the percentage growth of establishments with zero employees in period $t-1$ cannot be calculated since it involves a division with zero. Therefore, growth is defined to be zero if the number of employees is zero in period $t-1$ and period t . Moreover, growth is set at 100 percent if the number of employees is zero in period $t-1$ and more than zero in period t . This is the lowest rate of growth for establishments with one employee in time $t-1$ that expand their employment. Thus, this approximation underestimates the percentage employment growth of establishments with zero employees.⁷

Explanatory variables:

$AGE_{i,t-1}$: The age of the establishment i at time $t-1$. SCB registers the establishment when it becomes active by month and year.⁸ An establishment starting at time $t-1$ is defined to be 1 year old, an establishment starting in time $t-2$ is defined to be 2 years old and so on.

$SIZE_{i,t-1}$: The size, number of employees of establishment i at time $t-1$.

$AGE^2_{i,t-1}$: The age the establishment i at time $t-1$, raised to the second power. It is reasonable to expect a non-linear relationship between age and size, on the one hand, and growth, on the other. In line with practice in other similar studies, we use a quadratic form of age and size as explanatory variables.

$SIZE^2_{i,t-1}$: The size, number of employees of the establishment i at time $t-1$ raised to the second power.

⁷ Regressions where the dependent variable growth has been defined as the change in the number of employees in establishment i between time $t-1$ and t in absolute terms has also been conducted. The results are robust to this change of specification.

⁸ Each establishment has an “activity code” taking on one of three values: 0 – the business activity has not yet started, 1 – the establishment has started its business activity, i.e., it is an active establishment, and 9 – the establishment has closed its business activity. An establishment is new the first year the activity code is set to 1. Similarly, an establishment is defined as having exited when the activity code is changed to 9.

$OWNER_{i,t-1}$: A dummy for ownership at time $t-1$, 1 if establishment i is owned by the government and 0 if it is privately owned. An establishment is defined as governmentally owned if government controls more than 50 percent of the votes of the firm that owns the establishment.

$UPPSALA_{i,t}$: A dummy taking on the value 1 if the establishment is situated in the municipality of Uppsala, i.e. if the establishment has the municipality code 380, otherwise 0.⁹

$INTERACTION_{i,t}$: An interaction variable defined as $UPPSALA_{i,t-1} * EXIT_{i,t-1}$. The interaction variable catches the regional effect on employment growth of the withdrawal of Pharmacia from the Uppsala region. $EXIT_{i,t}$ is a dummy taking on the value 1 when Pharmacia “exited” from the region in 1995 and the time after, otherwise 0, it is not included as an explanatory variable by itself in the model.

Dummy variables:

$DPHARMA$: A dummy taking on the value 1 if establishment i manufactures pharmaceuticals, otherwise 0.¹⁰

$DINSTRUMENT$: A dummy variable taking on the value 1 if establishment i manufactures medical instruments or laboratory equipment, otherwise 0.¹¹

Three basic models are discussed in the literature when analysing cross-sectional time-series data econometrically: i) The ordinary least square (OLS) method, ii) the random-effects method and iii) the fixed-effect method (see, e.g., BALTAGI, 1999; HSIAO, 1999; and GREEN, 2000). The OLS estimation assumes no individual-specific effect (μ_i) or time-specific effect (λ_t). The random-effect model assumes the individual specific effects (μ_i) to be random across time and the time-specific effects (λ_t) to be random across individuals. Moreover, the random-effect model assumes the disturbances ($u_{i,t}$) and the explanatory variables to be uncorrelated. The fixed-effect model assumes the effects (μ_i) and (λ_t) to be constant.

An F-test applied to the data rejects the poolability of the data, i.e., an OLS analysis is not suitable. A Hausman test rejects the hypothesis that the disturbances ($u_{i,t}$) and the explanatory variables are uncorrelated. Thus, the fixed-effect model is used.

⁹ We have also done regressions on the county of Uppsala, that is municipality codes: 305, 319, 360, 380, 381 and 382. The results are robust to these changes.

¹⁰ That is, if establishment i is classified within industry code 24410 or 24420.

¹¹ That is, if establishment i is classified within industry code 33101, 33102, 33200 or 33400.

In accordance with the previous discussion the hypothesis to be tested is:

$$H_0: \beta_{\text{interaction}} < 0$$

In addition we also stress a number of supplementary hypotheses that are also tested econometrically in this paper, all common in research, see for example WAGNER, 1995; ALMUS and NERLINGER, 1999; and DAVIDSSON *et al.*, 2002:

H_0 : Firm age has no, or a positive, effect on firm growth.

H_1 : Firm age has a negative effect on firm growth.

H_0 : Firm size has no, or a positive, effect on firm growth.

H_1 : Firm size has a negative effect on firm growth.

H_0 : Government ownership has no, or a positive, effect on firm growth.

H_1 : Government ownership has a negative effect on firm growth.

We expect that the three additional hypotheses will be rejected in favour of the alternative hypothesis, i.e. that there is a negative relationship i) between firm age and firm growth ii) between firm size and firm growth as well as iii) between government ownership and firm growth. This is so because;

i) On average new firms will grow faster than old firms, as radically new innovations with a great economic potential are generally expected to be introduced through the entry of new and young firms (ACS and AUDRETSCH, 1987a, 1987b, 1988). Old firms are on average regarded as more conservative and relying on well-known technology and as being locked into their old structures. They are also often large and have built-in difficulties when it comes to reorganising for new market conditions (ALMEIDA, 1999). On the other hand, exploring new terrain is risky, and a large fraction of the new and small firms should be expected to fail. Several other researchers have also found a negative relationship between age and growth; see for example ALMUS and NERLINGER, 1999; WAGNER, 1995; and DAVIDSSON *et al.*, 2002.

ii) Further large firms have a reduced capability to generate and identify winners per unit of resource input compared to a corresponding number of small firms. The large firm, furthermore, have much larger resources for keeping bad projects longer, that would otherwise be rejected fast in the open market (ELIASSON and ELIASSON, 1996). From this it follows that the selection process is expected to be more dynamically efficient in terms of project selection in a group of small firms than in a large firm, this has also been emphasised by CARLSSON (1999). Also, small firms are more likely to provide a better entrepreneurial milieu than large firms because large firms have to be hierarchically organised due to their size (HANNAN and FREEMAN, 1984; and ACS and AUDRETSCH, 1987a, 1987b). Size seems to be negatively related to growth. This has been demonstrated in a number of empirical studies; EVANS, 1987a, 1987b; ALMUS and NERLINGER, 1999; HALL, 1987; WAGNER, 1995; and DAVIDSSON *et al.*, 2002. Also, see SUTTON, 1997, for a summary on the relationship between firm size and firm growth.

iii) Government or public ownership is expected to have a negative effect on growth for several reasons. First, in the free market, there will be a selection according to the owners' ability to manage the firm while politicians are appointed because of their competence to win elections (PELIKAN, 1988, 1993). Second, decision-making is bureaucratic in organisations run by politicians and often lacks flexibility (MOE, 1997; and WINTROBE, 1997). Third, since politically run organisations are managed by other criteria than economic efficiency, for instance vote maximisation (BERGGREN, 2000), they will have great difficulties accepting and correcting mistakes, such as closing down an operation or a firm because of a business mistake (ELIASSON, 1990). See, e.g., VARIYAM *et al.*, 1992; and DEWENTER and MALATESTA, 2001 for empirical investigations of ownership and the economic performance of firms.

Hence we also test if:

$$H_0: \beta_{\text{age}} \geq 0$$

$$H_0: \beta_{\text{size}} \geq 0.$$

$$H_0: \beta_{\text{owner}} \geq 0.$$

All null hypotheses stressed above, are expected to be rejected. Age and size are expected to be negatively related to firm growth. Governmentally owned establishments are expected to grow more slowly than private establishments. And most interesting, the "exit" of Pharmacia is expected to have negative effect on employment growth. If the first hypothesis can be rejected it

means that we can keep H_1 , that the withdrawal of Pharmacia in the Uppsala region has had no or a positive effect on growth in the region.

5. RESULTS

The correlations between the variables, as presented in Table 2, give us some indications of the relationship between the variables. The correlations between the variables are low. The only exception is a high correlation between, AGE and AGE² and SIZE and SIZE², which is not surprising. There is a weak correlation between EXIT and the AGE of the establishment.

Table 2. Table of correlations

	GROWTH	AGE	SIZE	AGE2	SIZE2	OWNER	UPPSALA	EXIT	INTERACTION
GROWTH	1	-.015	.003	-.013	.003	.004	.001	-.025	.001
AGE	-.015	1	.014	.945	.002	-.014	.004	.191	.022
SIZE	.003	.014	1	.033	.894	.071	.023	-.008	.016
AGE2	-.013	.945	.033	1	.015	-.010	-.001	.166	.017
SIZE2	.003	.002	.894	.015	1	.011	.015	-.004	.010
OWNER	.004	-.014	.071	-.010	.011	1	.124	.006	.112
UPPSALA	.001	.004	.023	-.001	.015	.124	1	.006	.876
EXIT	-.025	.191	-.008	.166	-.004	.006	.006	1	.113
INTERACTION	.001	.022	.016	.017	.010	.112	.876	.113	1

Source: Statistics Sweden and own calculations.

In Table 3 the main explanatory variables, their mean, standard deviation and expected effect on growth are summarised.

Table 3. Summary statistics

<i>Variable</i>	<i>Description</i>	<i>Mean</i>	<i>Std. dev.</i>	<i>Expected effect on growth</i>
<i>GROWTH</i>	Growth of employees (per cent)	1.22	116.47	
<i>AGE</i>	Age of establishment (year)	4.25	3.84	-
<i>SIZE</i>	Size of establishment (employees)	10.89	78.59	-
<i>AGE2</i>	The quadratic form of age	32.81	48.38	+
<i>SIZE2</i>	The quadratic form of size	6294.10	116578.24	+
<i>OWNER</i>	The establishment is owned by the government	.03	.18	-
<i>UPPSALA</i>	Municipality belonging (Uppsala)	.05	.22	
<i>EXIT</i>	Exit of Pharmacia	.77	.42	
<i>INTERACTION</i>	Exit of Pharmacia * municipality belonging (Uppsala)	.04	.20	0 or +

Source: Statistic Sweden and own calculations.

Turning to the regression results, Table 4 reports two different regressions. The regressions are done with the fixed-effect estimation technique.

Table 4. Results from the regression

<i>Variable</i>	<i>Regression 1</i>	<i>Regression 2</i>
	<i>GROWTH</i>	<i>GROWTH</i>
<i>AGE</i>	-.511 (-.512)	-.511 (-.524)
<i>SIZE</i>	-9.215E-03 (-.265)	-9.443E-03 (-.272)
<i>AGE²</i>	2.672E-02 (.364)	2.717E-02 (.370)
<i>SIZE²</i>	9.141E-06 (.385)	9.044E-06 (.380)
<i>OWNER</i>	-3.406 (-.578)	-3.801 (-.648)
<i>UPPSALA</i>	-8.318 (-.789)	–
<i>INTERACTION</i>	7.596 (.618)	-.591 (-.089)
<i>R²</i>	0.003	0.003
<i>R²_{adjusted}</i>	0.001	0.001

Source: Statistics Sweden and own calculations.

Note: t-value in parentheses. N=28 792.

The R^2 in the first regression is low, 0.003. Other related studies also report low R^2 numbers e.g. EVANS, 1987b reports 0.14 and JOHANSSON, 2001 reports 0.019. The low R^2 is not surprising. Many, important explanatory variables are missing. A number of important explanatory variables had to be excluded because no data were available. All these variables are for the most part difficult to measure, even at the disaggregated level of our analysis.

The result from the first regression largely supports other empirical studies on Swedish industry showing that age and size is negatively related to growth (see, e.g., DAVIDSSON *et al.*, 1994a; 1994b; HESHMATI, 2001; and JOHANSSON, 2001). The signs of the beta values supports the hypotheses outlined in the paper. They indicate that age, size and government ownership have a negative effect on growth. But the beta values are insignificant and we cannot reject the H_0 hypotheses.

However, the marginal effects of AGE and SIZE on growth are more interesting. They are calculated and presented in Table 5. These marginal effects are not significant. However, the sign of the beta values and of the t-values are negative for AGE. For SIZE we cannot predict the effect it will have on growth.

Table 5. Marginal effects of age and size on growth

Variable	Regression 1	Regression 2
AGE	-0.28 (-0.00069)	-0.28 (-0.000068)
SIZE	-0.009 (0.00000)	-0.009 (0.00000)

Source: Statistics Sweden and own calculations.

Note: The marginal effect of age on growth is calculated as: $dGROWTH/dAGE = \beta_{age} + 2 * \beta_{age,2} * AGE_{avg}$, where AGE_{avg} is the average age of firms. The standard error used to calculate t values is calculated as: $\sigma_{dGROWTH/dAGE} = [\text{var}(\beta_{age}) + 4 * (AGE_{avg})^2 * \text{var}(\beta_{age,2}) + 4 * AGE_{avg} * \text{cov}(\beta_{age}, \beta_{age,2})]^{1/2}$. The marginal effect of size on growth is calculated in similar way.

The most interesting variable is, however, the INTERACTION variable. We cannot reject the H_0 hypothesis. However, the beta coefficients, although insignificant, has the right sign. This indicates more new firm entry (establishments) and expansion of existing firms because of the Pharmacia withdrawal. Hence, the exit of Pharmacia from Uppsala – the largest employer in Uppsala – has no negative effect on employment. The econometric analysis is also supported by the descriptive analysis in the preceding section, which showed that employment in the pharmaceutical industry increased in Uppsala during the studied period.

6. SUMMARY AND CONCLUSIONS

In this paper we study the effect on employment in the pharmaceutical and medical technology industries of the withdrawal of Pharmacia in the Uppsala region because of the merger with Upjohn in 1995. Our hypothesis, that we test econometrically, anticipates that the gradual withdrawal of Pharmacia release resources with an economic potential. Most of these resources are embodied in well-educated and industrially experienced individuals who have left, or lost their jobs in Pharmacia. It may be the case that the withdrawal puts a dynamic process in motion generating new and expanding firms that compensate for the initial employment loss. Therefore, the exit of Pharmacia may not have had a negative effect on total employment in the region not even in the short run.

We could not reject our hypothesis that the exit of Pharmacia from the Uppsala region had no or a negative effect on employment. This implies that the withdrawal of Pharmacia did not lead to a decreased employment within the pharmaceutical and medical technology industry in the Uppsala region. The econometric result is also supported by the descriptive analysis showing that the employment in the industry *increased* after the exit of Pharmacia. One should also take into consideration that it goes fast to close down an industry while the total effects from new firm entry and expansion of firms probably will take longer time to show up. This means that our analysis, based on a rather short time period, probably relatively overestimates the negative effects of the exit compared to the positive effects on firm entry and firm expansion.

This indicates more new establishments and expansion of existing firms. However, does this mean that the recommendation for policy should be to close down companies that are major employers? Of course not. Rather the result indicates that we should not support non-competitive large firms that have been the case so many times due to concerns about unemployment.

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