# Asthma and allergy: the significance of chronic conditions for individual health behaviour.

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## Original article

# Asthma and allergy: the significance of chronic conditions for individual health behaviour

**Background:** In health economics, health is regarded as part of an individual's human capital. As such it depreciates over time, and investments in health are made in order to keep the stock of health capital at the desired level. Using this framework for analysis of health-related behaviour and Swedish panel data, we examined whether the presence of asthma or allergy affects perceived health and investments in health.
**Methods:** A set of panel data for approximately 3800 individuals interviewed repeatedly in 1980/81, 1988/89, and 1996/97 was created from the Swedish biannual survey of living conditions. Self-assessed health was chosen as the indicator of health capital and the reported number of sick days as the indicator of health investment. The presence of asthma or allergy, age, wage rate, wealth, marital status, number of children, exercise and smoking habits, gender, and geographic location of household were all chosen as explanatory variables. An ordered probit model was estimated for the health equation and a Poisson model for the investment equation.
**Results:** We found that both asthmatics and those who suffer from allergy invested more in their health than the general population. We also found that asthmatics reported significantly lower self-assessed health than the general population, while those who suffered from allergy did not differ significantly from the general population regarding their self-assessed health.
**Conclusion:** The human capital approach was found suitable for studying the impact of asthma and allergy on individual health behaviour. Health policy measures, which reduce the individual's costs of investing in his or her health, would improve health levels. Because asthmatics were found less healthy than those suffering from allergy, the potential gains would be larger for patients with asthma than for patients with allergy. The issue of whether this would be a cost-effective policy or not would require a different design and, hence, could not be solved within the present study.

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Key words: allergy; asthma; economics; Grossman model; health behaviour; self-assessed health.

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Asthma and allergy inflict suffering in a variety of ways for those individuals who are stricken with these diseases. An individual who suffers from asthma or allergy may be forced to change his or her lifestyle in order to avoid, or reduce, allergic reactions, and to spend a lot of time in the health-care system. Other activities, such as working, studying or enjoying one's leisure time, will have to be diminished. Furthermore, those suffering from asthma or allergy may experience reductions in income as a consequence of absence from work and less paid employment. Additionally, not only the individual who suffers from asthma or allergy is affected but also that individual's family, for example, because the environment in the home may have to be adapted to the preconditions of the affected individual. Also, for society at large, there are significant public health consequences from asthma and allergy, because they reduce the well-being of a substantial and increasing share of the population in most countries, even though the prevalence rates may differ (1–7).

Thus, asthma and allergy not only cause significant personal sufferings but they also have a substantial economic impact on society at large. In Sweden, for instance, asthma and allergy accounted for approximately 2% of the total costs of illness both in 1980 and in 1991 (8–10). The share of asthma was 52%, while allergy (here consisting of the three diagnoses rhinitis allergica, eczema atopicum prurigo Besnier, and eczema allergicum) together accounted for 48%. Indirect costs (loss of productivity) accounted for the major part (63%), while outpatient care (GP visits included), pharmaceuticals, and inpatient care accounted for 19, 11, and 7%, respectively, during 1991. Productivity losses and inpatient costs decreased whereas outpatient and, in particular, pharmaceutical costs increased between 1980 and 1991. Similar findings on the economic impact of asthma and allergy have been reported from other countries, for instance, the United States (11–17).

The total cost of asthma and allergy is the result of a number of interdependent factors: for example, the prevalence of disease, the medical technology used, and the incentives to patients and doctors created by the way health care and insurance systems are organized. Therefore, the estimated cost is dependent on time and place. Differences in the regulation of health care or health insurance may explain differences in estimated costs among countries, moreover the opportunity cost of illness may change over time in a specific country, because of improvements in medical technology, changes in the prevalence of disease, changes in overall productivity, or changes in individual behaviour (18).

Individual behaviour is a crucial determinant of the cost of illness, and understanding individual health-related behaviour is essential, for instance, for policy-making. A central theoretical model for analyzing health behaviour within health economics is the 'demand-for-health' model introduced by Grossman (19, 20). Further developments of the model include (21–26); for a survey and review, see (27). According to this model, the individual both demands and produces his or her own health. Naturally, the notion of 'producer of health' does not mean that the individual determines his or her state of health – heredity, environment, and chance are three factors which may interfere – but rather that the individual can and does influence it quite substantially. Health is produced by choosing life style, making better and worse health states more or less probable, and by using medical advice, pharmaceuticals, hospital treatment, etc. in order to restore good health (28).

Grossman's introduction of the demand-for-health model (19, 20) constituted an advance in the economic analysis of individual health behaviour and resulted in that health henceforth could be analyzed in the same way as other types of human capital. Thus, in analogy with investments in market-related human capital, e.g., education, aiming at increasing one's income and at reducing the risk of unemployment, it is possible to invest in one's health. However, health capital is intrinsically different from other types of human capital in one particular way: while other types of human capital increase productivity, health capital affects the time available for productive use – the investment aspect of health. In addition, there is also a consumption aspect of health, which means that individuals enjoy good health in its own right.

In the demand-for-health model it is assumed that the stock of health capital depreciates at a rate which increases with time; the depreciation rate may differ among individuals. In order to keep the stock of health capital at the desired level, the individual has to make investments in health capital. Further, because the stock of health capital depreciates at each point in time, the investments made will also depreciate at that point in time. Therefore, the model distinguishes between produced health investments, or gross health investments, and the realized increase in the stock of health capital, or net health investments, which, hence, equals gross health investment minus depreciation. Furthermore, if the individual experiences (psychic, time or monetary) costs when adjusting from actual to a desired level of health, it pays for the individual to spread his or her gross investments in health and make partial adjustments to the desired stock of health in future time periods. If the individual, however, perceives no costs of adjustment from actual to desired, or demanded, stock of health, actual stock of health capital always equals desired stock of health capital; the adjustment from actual to desired stock of health is instantaneous.

Gross health investments are produced by the individual (or the household) with market-produced goods (medical care, for instance) and own time as inputs to production. Individual health behaviour is influenced by the fact that the individual both demands and produces his or her own health. Exogenous forces may affect the individual's demand for health, the individual's production of health, or both. This dichotomy of the individual's health behaviour in demand and supply factors will be used when predicting the effects of various variables on the demand for health and health investments.

Empirical estimations of the demand for health model have used American (20), Finnish (29), Danish (30), and Swedish data (31). The idea that there might be a cost for adjusting from actual to desired stock of health has been introduced (32) and further extended (33). Bolin *et al.* (33) developed a theoretical and empirical cost-of-adjustment version of the Grossman model, based on the specifications suggested by Jacobson (23) and Grossman (27). In their model (33), both past and future stocks of health are expected to be positively correlated with the current stock of health. The model was estimated using individual panel data from a sample of all 16–84 years old Swedes in 1980/1981, 1988/89, and 1996/97. The study did not focus any particular health condition.

The purpose of this study was to examine whether those who suffer from the chronic conditions of asthma and allergy differ from the general population regarding their health and health-related behaviour, using the theoretical and empirical framework developed by Bolin *et al.* (33) and the same data set. Thus, the model takes into account the fact that most individuals lead a great part of their lives in families, a fact that influences health and health-related behaviour. The paper proceeds as follows. First, the predictions from our theoretical and empirical framework (33) will be reproduced. Secondly and thirdly, the data will be presented and the specific empirical methods used in the paper described. Fourthly, the models will be estimated and the effects of asthma and allergy, respectively, will be examined separately. Finally, the paper concludes with a discussion of the results. The paper complies with the recommendations of the EAACI nomenclature task force (34).

**Predictions**

The predictions regarding the effect of exogenous variables on demand for health and health investments following from the theoretical and empirical framework (33) are summarized in Table 1. The predictions regarding asthma and allergy are explained below. The reader is referred to (33) for derivations of the predictions.

Table 1Predictions concerning the effects on the demand for health capital and health investment from changes in explanatory variables

| Variable | Health capital | Health investment |
|---|---|---|
| Age | − | + − |
| Wage | + − | + − |
| Asthma | − | + − |
| Allergy | − | + − |
| Wealth | + | + |
| Married or cohabiting | + | + |
| Children | + − | − |
| Sex | + − | + − |

See reference (33).

The impact of asthma and allergy

The presence of asthma or allergy is predicted to lower the level of health, whereas the effect on investments in health is indeterminate. People who suffer from asthma or allergy will have higher rates of depreciation and, hence, have higher net costs of health capital than those without chronic illnesses. This will lower their demand for health and their realised health levels. Moreover, people who suffer from asthma or allergy may be less efficient producers of gross health investments. Thus, an individual who suffers from asthma or allergy may produce a smaller amount of gross health investment from a given amount of inputs such as time and health care. If productivity is sufficiently low, the demand for gross health investment will increase, even though there is a decrease in the demand for health. If not, the demand for gross health investment will decrease.

Cost of adjustment from actual to desired stock of health

Adjustments to a desired level of health seldom can be done instantaneously without a cost. It therefore pays for the individual to spread his or her gross investments in health and make partial adjustments to the desired stock of health in future time periods. It follows that positive correlations between the current stock of health capital and both the past and the future stock of health capital, respectively, would then be expected (27). It also follows that, while past investments in health should be positively correlated with the future stock of health, they should be negatively correlated with the past stock of health.

**Data and statistical methods**

Data

A set of individual panel data was created from the Swedish biannual survey of living conditions, ULF (Undersökningar av levnadsförhållanden). In ULF, a sample of approximately 16,000 people, 16–84 years' old, are interviewed about their living conditions; the response rate is normally 80–85%. Every survey covers a number of areas: housing, leisure, health, employment, education, private financial situation, and social relations. Responses are supplemented from administrative registers with individual data on income, taxes and various transfer payments. There is also a rolling schedule of extra coverage of some specific areas every 8th year. Thus, there was both a broader and deeper coverage of health-related variables in 1980/81, 1988/89, and 1996/97. Furthermore, approximately 40% of the respondents are part of a rotating panel in which respondents are interviewed every 8th year. Thus, the data set that we used contained health-related and background information for a panel consisting of approximately 3800 individuals for the years 1980/81, 1988/89, and 1996/97.

The choice of year of observation for each variable must be consistent with the empirical model. Thus, we used the indicator for health in 1980/81, 1988/89 and 1996/97, the indicator for health investment in 1980/81, and explanatory variables for 1988/89. Chosen variables from the data set are described below; means and standard deviations are reported in Table 2.

Dependent variables

- SRH1 is a discrete variable, which reflects the self-assessed health in 1988/89. The respondent was asked to report his or her health status as one of three categories: 1, 2 or 3, where 3 is the category with highest health status. (All dependent discrete variables were re-scaled so that the ordinal scale begins at 0). The variable was chosen in order to be an indicator of the unobserved variable health.
- DAYS is a count variable for the number of days of work-absenteeism during the last 3 weeks prior to the interview in 1980/81.

Explanatory variables

- SRH0 is the same as SRH1 but for 1980/81.
- SRH2 is the same as SRH1 but for 1996/97.
- ASTHMA is a dummy variable, which takes the

Table 2 Descriptive statistics. Mean values and standard deviations of dependent and explanatory variables. The values are calculated using individuals who participated in all the ULF surveys of 1980/81, 1988/89, and 1996/97

| | Total sample ($n=3749$) | | Asthmatic ($n=72$) | | Allergic ($n=83$) | |
|---|---|---|---|---|---|---|
| Variable | Mean | SD | Mean | SD | Mean | SD |
| Dependent variables | | | | | | |
| SRH1 | 2.76 | 0.49 | 2.28 | 0.74 | 2.76 | 0.50 |
| DAYS | 0.59 | 2.41 | 1.90 | 4.33 | 0.75 | 2.48 |
| Explanatory variables | | | | | | |
| Srh0 | 2.80 | 0.46 | 2.32 | 0.77 | 2.78 | 0.48 |
| Srh2 | 2.31 | 0.58 | 1.94 | 0.67 | 2.22 | 0.58 |
| Age | 46.63 | 14.60 | 48.05 | 15.38 | 39.21 | 12.91 |
| Wage | 52.27 | 48.20 | 45.45 | 39.89 | 56.78 | 33.87 |
| Asthma | 0.019 | 0.137 | – | – | 0.08 | 0.27 |
| Allergy | 0.022 | 0.147 | 0.15 | 0.36 | – | – |
| Wealth | 2262.00 | 9100.00 | 3979.0 | 12989.00 | 868.00 | 1977.00 |
| North | 0.23 | 0.42 | 0.23 | 0.43 | 0.25 | 0.44 |
| Exercise | 2.78 | 1.20 | 2.61 | 1.20 | 2.72 | 1.19 |
| Smoker | 0.27 | 0.44 | 0.24 | 0.43 | 0.22 | 0.42 |
| F smoker | 0.28 | 0.45 | 0.29 | 0.46 | 0.31 | 0.46 |
| Married | 0.75 | 0.43 | 0.79 | 0.41 | 0.70 | 0.46 |
| Child | 0.86 | 1.09 | 0.89 | 1.08 | 0.94 | 1.17 |
| Sex | 0.47 | 0.50 | 0.44 | 0.50 | 0.41 | 0.49 |

value 1, if the respondent was diagnosed with asthma in 1988/89 and 0 otherwise. (A respondent was defined as being an asthmatic if he or she stated that he or she had been diagnosed with code 493 according to the ICD9 coding).

- ALLERGY is a dummy variable, which takes the value 1, if the respondent was diagnosed with allergy in 1988/89 and 0 otherwise. (A respondent was defined as suffering from allergy if he or she stated that he or she had been diagnosed with at least one of the codes 477, 691, or 692 according to the ICD9 coding).
- AGE is the respondent's age in years in the panel 1988/89.
- WAGE is a continuous variable for the respondent's wage rate.
- WEALTH is the respondent's income from capital in 1988/89. Measured in hundreds of SEK.
- MARRIED is a dummy variable, which takes the value 1, if the respondent was either married or cohabiting in 1988/1989 and 0 otherwise.
- CHILD is the number of children 1988/1989 in the household.
- EXERCISE is a discrete variable, which can take the values 1, 2, 3, 4 or 5, where 1 indicates that the respondent does not exercise at all; 5 indicates that the respondent exercises regularly at least twice a week; and 2, 3 and 4 indicate exercise levels in between. The exercise levels are for 1988/89.
- SMOKER is a dummy variable, which takes the value 1, if the respondent is a smoker (smokes daily) and 0 otherwise;
- FSMOKER is a dummy variable, which takes the value 1, if the respondent has been a smoker and 0 otherwise.
- SEX reflects sex: 0 corresponds to the respondent being a female and 1 corresponds to the respondent being a male.
- NORTH is a dummy variable, which takes the value 1, if the respondent was living in the north of Sweden in 1988/89 and 0 otherwise.

### Statistical method

Self-assessed health was reported as an ordinal ranking, so we estimated an ordered probit model for the demand-for-health equation (35, pp. 926–931). Since, however, the number of days of work-absenteeism is a count variable, we estimated a Poisson model for the investment equation (35, pp. 931–935).

For each independent variable, the marginal effect, i.e., the effect on the dependent variable of a change in an explanatory variable, will be calculated. In a linear regression model, for instance, the ordinary least squares (OLS) model, the marginal effect is identical with the estimated parameter coefficient and, hence, obtained automatically. However, in a nonlinear regression model such as the present one, there is no such relationship. Instead, the marginal effects have to be calculated, given the estimated parameters.

## Results

The main results are summarized in Table 3. The results from the two sets of estimated equations were qualitatively identical, i.e., a significant marginal effect (at the 5% level) had the same sign, regardless of whether the condition was asthma or allergy.

Table 3 Estimated effects on the demand for health capital and health investment from changes in independent variables for people suffering from asthma and allergy, respectively, in relation to the general population

| Variable | Asthma | | Allergy | |
|---|---|---|---|---|
| | Health capital | Health investment | Health capital | Health investment |
| Srh0 | + | − | + | − |
| Srh2 | + | − | + | − |
| Asthma/allergy | − | + | n.s. | + |
| Age | − | − | − | − |
| Wage | + | n.s. | + | n.s. |
| Wealth | + | + | + | + |
| North | − | n.s. | n.s. | n.s. |
| Exercise | + | + | + | + |
| Smoker | − | + | n.s. | + |
| Fsmoker | − | + | − | + |
| Married | + | n.s. | + | n.s. |
| Child | n.s. | n.s. | n.s. | n.s. |
| Sex | + | − | + | − |

### The impact of asthma and allergy

While asthmatics, as expected, were found to be less healthy than the general population, the health levels reported by those who suffer from allergy did not differ significantly from the general population. However, both asthmatics and those who suffer from allergy invested more in health, days of work-absenteeism, than the general population.

### Other variables

There was a significant decrease in the demand for health investment with age. The estimated marginal effect of an increase in the wage rate was positive for the demand for health while not significant for the number of days of work-absenteeism. This implies that the investment aspects of health capital out-weighed the consumption aspects; an increase in the wage rate would make health capital relatively more valuable and induce the individual to increase his or her stock of health capital.

Both smokers and former smokers were found to demand lower levels of health capital than those who had never smoked. However, smokers and former smokers were also found to invest more in health than the general population. Our result implies that the change in the supply of health capital exceeded the change in the demand for health capital.

Men appeared to be healthier than women. The number of days of work-absenteeism was higher, however, if the respondent was a woman; in other words, women seemed to invest more in their health than men do.

### Estimated marginal effects

Estimated marginal effects are presented in detail in Tables 4–7. The marginal effect indicates how the probability of observing a specific value for the dependent variable changes when that independent variable changes. For example: the marginal effect of the variable *asthma* connected to the lowest health state, $srh1 = 0$, is positive (Table 4). Because the variable ASTHMA takes the value 1 if the respondent is an asthmatic and 0 otherwise, the calculated marginal effect implies that, if the respondent is an asthmatic, the probability that he or she perceives himself or herself to be in the lowest health status increases.

## Discussion and conclusion

In this paper, we examined the effects of asthma and allergy on individual health behaviour. We estimated a dynamic cost-of-adjustment model of the demand for health and health investments. According to our results, asthma affected both health level (negatively) and gross health investment (positively). The relationship between

Table 4 Marginal effects for the ordered probit model of the health capital equation. Self-assessed health as indicator of health capital[1]

| Variable | Srh1 = 0 (low) | | Srh1 = 1 (medium) | | Srh1 = 2 (high) | |
|---|---|---|---|---|---|---|
| | Marginal effects | *P*-values | Marginal effects | *P*-values | Marginal effects | *P*-values |
| Constant | −0.004 | 0.251 | −0.035 | 0.188 | 0.040 | 0.189 |
| Srh0 | − **0.016*** | 0.000 | − **0.148*** | 0.000 | **0.164*** | 0.000 |
| Srh2 | − **0.015*** | 0.000 | − **0.141*** | 0.000 | **0.155*** | 0.000 |
| Age | **2.0E-4*** | 0.000 | **0.002** | 0.073 | − **0.002*** | 0.000 |
| Wage | − **2.676*** | 0.035 | −25.620 | 0.277 | **28.296*** | 0.033 |
| Asthma | **0.011*** | 0.001 | 0.109 | 0.141 | − **0.120*** | 0.000 |
| Wealth | − **0.017*** | 0.031 | −0.167 | 0.273 | **0.184*** | 0.029 |
| North | **0.002** | 0.056 | 0.020 | 0.308 | − **0.022** | 0.057 |
| Exercise | − **0.004*** | 0.000 | − **0.035*** | 0.007 | **0.038*** | 0.000 |
| Smoker | **0.002** | 0.095 | 0.017 | 0.342 | −0.019 | 0.103 |
| Fsmoker | **0.004*** | 0.002 | 0.038 | 0.182 | − **0.043*** | 0.002 |
| Married | − **0.002*** | 0.048 | −0.021 | 0.299 | **0.023*** | 0.049 |
| Child | −5.0E-4 | 0.197 | −0.005 | 0.382 | 0.006 | 0.172 |
| Sex | − **0.003*** | 0.016 | −0.025 | 0.246 | **0.027*** | 0.016 |

[1]Bold indicates that the estimated coefficient is significant at the 10% level, and bold and * indicate that the coefficient is significant at the 5% level. Notice that in order for LIMDEP to work we had to rescale the dependent variables. 1 has been assigned the value 0, 2 has been assigned the value 1 and so on.

Table 5 Marginal effects for the Poisson model of the health investment equation. Work-absenteeism as indicator of health investments[1]. Asthma included as an explanatory variable!

| | Change in the expected number of days of work-absenteeism | |
|---|---|---|
| Variable | Marginal effect | *P*-value |
| Constant | **0.574*** | 0.000 |
| Srh0 | − **0.530*** | 0.000 |
| Srh2 | − **0.122*** | 0.000 |
| Age | − **0.005*** | 0.000 |
| Wage | 18.870 | 0.611 |
| Asthma | **0.391*** | 0.000 |
| Wealth | **0.396*** | 0.000 |
| North | 0.006 | 0.889 |
| Exercise | **0.086*** | 0.000 |
| Smoker | **0.360*** | 0.000 |
| Fsmoker | **0.259*** | 0.000 |
| Married | 0.010 | 0.804 |
| Child | −0.004 | 0.818 |
| Sex | − **0.113*** | 0.001 |

[1]Bold indicates that the estimated coefficient is significant at the 10% level, and bold and * indicate that the coefficient is significant at the 5% level.

allergy and the health level was not statistically significant, but there was a statistically significant positive correlation between allergy and health investment. Certainly, there are a few studies reporting lower health-related quality for patients with asthma and/or allergy but apparently with no direct comparison with the general population (36–43). Our result may indicate that asthma after all is perceived as a more severe disease including a not negligible mortality risk.

This study focused on the importance of chronic illnesses, here, asthma and allergy, on health-related behaviour. However, concerning other variables than asthma and allergy, our results here were similar to the results for the general population obtained in our previous study (33). That health-related quality of life is not only influenced by the severity of disease but also by demographic and socioeconomic factors has also been reported elsewhere (44).

Besides the results concerning the relationships between asthma and allergy on one hand and individual health behaviour on the other, there are at least two additional results that are particularly important. Firstly, instantaneous adjustment of actual to desired health level was rejected, a finding which confirms the result in (33). Secondly, we found that the family structure has some importance for individual health behaviour because those married or cohabiting were found to be healthier than singles. This corroborates our own previous result (33) and is consistent with the findings of a positive correlation between being married and lower death rates (45–47). Obviously, this result may also be explained by selection effects, i.e., that those marrying are healthier than the average.

As health capital and health investment are unobservables, any empirical implementation of Grossman's demand-for-health model is faced with the problem of choosing indicators for the unobserved variables; different indicators for health capital and health investment have been used in previous research (19, 29–32). At first, the choice may seem decisive, because an incorrect representation would certainly make the estimates biased. Here, the problem appears to be small. It has been shown recently that the empirical results of the demand-for-health model are qualitatively robust as to the choice of empirical representations of health capital and health investments (33); different choices of relevant indicators of health capital and health investment produced almost identical qualitative results. Thus, the choice of empirical representations for health capital and health investment constitutes less of a problem than might be expected.

In our model, individuals produce gross health investment by using, for instance, work-absenteeism (own time) and health care as inputs. Lower costs of inputs in the individual health production function

Table 6 Marginal effects for the ordered probit model of the health capital equation. Self-assessed health as indicator of health capital[1]. Allergy included as an explantory variable!

| | Srh1 = 0(low) | | Srh1 = 1 (medium) | | Srh1 = 2 (high) | |
|---|---|---|---|---|---|---|
| Variable | Marginal effects | *P*-values | Marginal effects | *P*-values | Marginal effects | *P*-values |
| Constant | −0.002 | 0.345 | −0.019 | 0.319 | 0.021 | 0.319 |
| Srh0 | − **0.016*** | 0.000 | − **0.152*** | 0.000 | **0.168*** | 0.000 |
| Srh2 | − **0.015*** | 0.000 | − **0.142*** | 0.000 | **0.158*** | 0.000 |
| Age | **2.0E-4*** | 0.000 | **0.002** | 0.083 | − **0.002*** | 0.000 |
| Wage | − **2.696*** | 0.036 | −25.306 | 0.280 | **28.002*** | 0.034 |
| Allergy | 1.0E-4 | 0.489 | 0.001 | 0.496 | −0.001 | 0.487 |
| Wealth | − **0.016*** | 0.048 | −0.148 | 0.297 | **0.164*** | 0.047 |
| North | **0.002** | 0.059 | 0.020 | 0.308 | − **0.022** | 0.058 |
| Exercise | − **0.004*** | 0.000 | − **0.034*** | 0.008 | **0.038*** | 0.000 |
| Smoker | 0.002 | 0.112 | 0.016 | 0.353 | −0.017 | 0.120 |
| Fsmoker | **0.004*** | 0.002 | 0.038 | 0.182 | − **0.043*** | 0.002 |
| Married | − **0.002** | 0.059 | −0.020 | 0.306 | **0.022** | 0.056 |
| Child | −5.0E-4 | 0.203 | −0.005 | 0.386 | 0.006 | 0.179 |
| Sex | − **0.003*** | 0.017 | −0.024 | 0.247 | **0.027*** | 0.016 |

[1]Bold indicates that the estimated coefficient is significant at the 10% level, and bold and * indicate that the coefficient is significant at the 5% level. Notice that in order for LIMDEP to work we had to rescale the dependent variables. 1 had been assigned the value 0, 2 has been assigned the value 1 and so on.

Table 7 Marginal effects for the Poisson model of the health investment equation. Work-absenteeism as indicator of health investment[1]. Allergy included as an explantory variable[1]

| Variable | Change in the expected number of days of work-absenteeism: Marginal effect | *P*-value |
|---|---|---|
| Constant | **0.630***| 0.000 |
| Srh0 | − **0.553*** | 0.000 |
| Srh2 | − **0.126*** | 0.000 |
| Age | − **0.005*** | 0.000 |
| Wage | 19.260 | 0.599 |
| Allergy | **0.239*** | 0.008 |
| Wealth | **0.419*** | 0.000 |
| North | 0.003 | 0.942 |
| Exercise | **0.083*** | 0.000 |
| Smoker | **0.349*** | 0.000 |
| Fsmoker | **0.250*** | 0.000 |
| Married | 0.002 | 0.958 |
| Child | −0.006 | 0.740 |
| Sex | − **0.104*** | 0.002 |

[1]Bold indicates that the estimated coefficient is significant at the 10% level, and bold and * indicate that the coefficient is significant at the 5% level.

would increase the supply of health investments and the level of individual health. Thus, our empirical results may have implications also for public health policy. Health policy measures, which reduce the individual's costs of investing in his or her health, would improve health levels. Asthmatics were found less healthy than those suffering from allergy, hence the potential gains would be larger for patients with asthma than for patients with allergy. The issue of whether this would be a cost-effective policy or not would require a different design and, could therefore not be solved within the present study.

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