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In Pursuit of Promptness: Assessing the Link between Healthcare Waiting Time and Demand for Voluntary Health Insurance in Sweden

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Abstract

The demand for voluntary health insurance (VHI) in Sweden is growing, yet there is little evidence of what drives the growth. Research in other countries with universal healthcare indicates that waiting times in the healthcare system are the main driver for the increased demand. This study addresses two main questions: (i) Does waiting time in healthcare impact demand for voluntary health insurance in Sweden? and (ii) Does waiting time in healthcare impact demand for voluntary health insurance differently, depending on the origin of the insurance? To answer these questions, a novel dataset is constructed by combining data from the Swedish national-wide survey Riks-SOM 2016 and regional waiting time data provided by the Swedish Association of Local Authorities and Regions. Probit models are used to estimate the relationship between waiting time and demand for VHI. The potential endogeneity problem of simultaneity causality is mitigated by using lagged waiting time values. In line with previous research, we find a positive association of waiting time on demand for VHI. The results do however not suggest that the waiting time impacts the demand differently depending on the origin of the insurance.

Keywords: VHI, voluntary health insurance, private health insurance, waiting time, healthcare

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Contents

1 Introduction

Over the last decade, there has been great growth in the Swedish market for voluntary health insurance (VHI). In 2011 just over 435,000 individuals had one and by the end of 2021, that number had increased to over 720,000 individuals (Insurance Sweden, 2022). In 2021 the Swedish Ministry of Social Affairs published an extensive government official report covering the regulation of VHI. The report states that there is a lack of information on what drives the demand for VHI in Sweden. Students in economics learn that charging someone for a good that they can obtain for free would not make a successful business. For a consumer between the age of 30 and 34, the premium for a VHI varies from 2,000 to 6,000 SEK per year, and the premium for a consumer between 65 and 70 the premium varies from 10,000 to 25,000 (The Swedish Agency for Health and Care Services Analysis [SAHCSA], 2020). Nevertheless, the VHI market has emerged even though public healthcare comes at a low cost for the individual consumer. For example, in addition to the tax paid, a visit to a physician in specialist care costs between 100 to 400 SEK for an adult (Swedish Association of Local Authorities and Regions [SALAR], 2022). Students in economics also learn that a business that cannot compete with price has to compete in an alternative way. One possible explanation for the growing market in Sweden is that the insurance companies have taken advantage of inflexibilities in the public healthcare service. Examples of inflexibilities in public healthcare are accessibility, lack of individually-adapted healthcare, and customer service (SAHCSA, 2020).

There is no evident support for quality differences between private and public healthcare in Sweden regarding health outcomes (Kastberg and Siverbo, 2007; Lindgren, 2014). Waiting time has arguably been one of the most important inflexibility that drives demand for VHI. Consumers benefit from having a VHI since the insured is guaranteed specialized care more rapidly compared to the non-insured. VHI guarantees an appointment in specialized healthcare within 3-7 working days and 14-21 working days for surgery (SAHCSA, 2020). Public healthcare guarantees an appointment in specialist care within 90 days and a supplemental 90 days for surgery in the region of residency (SFS 2017:80). To the best of

our knowledge, there is no publicly available information on how well the insurance provider fulfills their guarantees. However, by comparing the guarantees it is evident that there ought to be differences in waiting time between public healthcare and healthcare received through a VHI. When comparing the trend of the share of people who have a VHI in Sweden and the trend of waiting time in public healthcare, these do not align (Tynkkynen et al., 2018). This indicates that waiting time is not the only driving factor of demand for VHI. The relationship between demand for VHI and waiting times in Sweden has however not previously been investigated while controlling for other factors. Based on this research gap, the first research question this study aims to answer is: *Does waiting time in healthcare impact demand for voluntary health insurance in Sweden?*

It is possible that the drivers of demand differ depending on the origin of the insurance. There are three common ways to obtain a VHI in Sweden. Consumers can purchase a VHI individually, purchase it through certain unions, or they can receive it from their employer if the employer offers this benefit. The latter two, are often associated with a lower premium compared to individually purchased insurance. If the employer offers a VHI, either the employer or the employee pays the premium (Insurance Sweden, 2017). In the remainder of the study, we refer to employer or union-provided but individually-paid VHI as a group plan. Hence, there are three types of origins of VHI: individually purchased, employer-paid and group plan.

The importance of the origin has previously been investigated in the United Kingdom and Norway and the results indicate that waiting time has a larger impact on demand for individual insurance than for employer-provided insurance (Besley, Hall and Preston, 1999; Aarbu, 2010). No market for VHI is an exact copy of another market (Thomson, Sagan and Mossialos, 2021), and the results from the international studies might therefore not be generalizable to the Swedish market. As of now, no study in Sweden has taken the effect of origin into account. In Sweden 2021, 60% of the VHIs are employer-paid, 30% are provided as group plans and 10% are individually purchased (Insurance Sweden, 2023). This highlights the importance of further examining the differences in drivers of demand depending on the origin of the insurance and for this reason, the second research question is: *Does waiting time in*

healthcare impact demand for voluntary health insurance differently, depending on the origin of the insurance?

The data used is a novel dataset with regional waiting time data from SALAR and VHI- as well as individual- and occupational characteristics on an individual level from Riks-SOM 2016. The data allows us to estimate the association between demand for VHI and waiting time while controlling for other factors that might impact the demand for VHI, which has not been done for the Swedish market previously. It also allows us to separate the different origins of the provision of VHI to investigate potential heterogeneity.

To estimate the relationship between the decision to get a VHI and waiting time, we use probit models and estimate average marginal effects. In order to adjust for non-response bias, post-stratification weights are applied. Since the survey is directed to individuals, there is limited information on their employers and unions. Despite the limited information, the separation of the types of origin could still provide an indication of how waiting time impacts demand differently.

Waiting time variables are constructed as averages of waiting times between 2010 and 2013. By not including waiting time from the year of the survey and two years prior, a possible endogeneity problem of simultaneity bias is mitigated. The problem arises if individuals with VHI opt out of the public sector. These consumers will consequently not seek medical treatment in the public sector to the same extent as non-insurance holders do, leading to decreasing waiting time (Kullberg, Blomqvist and Winblad, 2019). However, it could potentially also act in the opposite direction. If resources follow the same direction as the consumers, then this lack of resources in the public healthcare system might lead to increased waiting time (Lapidus, 2022). Independent of the sign of the association, there is potentially a problem of simultaneity causality. A detailed discussion on this matter is presented in section 5.2.2.

The findings in this study suggest that longer waiting time in healthcare has a positive association with demand for VHI in Sweden. This is in accordance with the expected- utility and profit theory as well as previous international studies. Contrary to previous studies, we do

not find that the association between waiting time and demand for VHI differs depending on the origin of the insurance. The contribution of this study is an increased knowledge of the VHI market in Sweden and how people value the quality of healthcare. The results should however be interpreted with caution due to the low statistical power of the econometric models and instead provide an indication of the relationships as well as guidance for future research.

2 Literature Review

Studies of the VHI market in Sweden have managed to provide descriptive evidence on the characteristics of individuals with a VHI. The literature provides an overview of the structural-demographic differences in Sweden between individuals with VHI and those without. Some of the structural differences they find are within gender, income, and age (Palme, 2017; Kullberg, Blomqvist and Winblad, 2019; SAHCSA, 2020). Since all these studies are purely descriptive, they do not capture the effects of what drives the demand for VHI.

Studies investigating the determinants of demand for VHI in countries with universal healthcare find that the inflexibilities of the public healthcare system have an impact on the decision to purchase a VHI (Propper, 2000; Olesen, 2009; Valtonen, Kempers and Karttunen, 2014). Costa and García (2003) analyze the perceived difference in quality between public and private healthcare in Catalonia, Spain, and its effect on demand for VHI. The study finds that the perceived quality gap between private and public healthcare has an effect on the demand for VHI. However, the perception of quality is a subjective measurement that might differ from other, more objective, quality measurements (Blix and Jordahl, 2021).

Waiting time is commonly used as a quality measurement of healthcare and is listed as the main reason for purchasing VHI in several surveys (Bolhaar and Lindeboom, 2008; Valtonen, Kempers and Karttunen, 2014; Sagan and Thomson, 2016; SAHCSA, 2020). Jofre-Bonet (2000) uses information on waiting time in public and private healthcare to measure the quality gap's impact on demand for VHI in Spain. The result indicates that an increase in public-private waiting time differentials is followed by an increase in demand for VHI. The econometric model used assumes that individually purchased VHI does not differ from VHI provided by an employer. She argues that the assumption holds, largely because 20%

of the VHIs in Spain at the time were provided through an employer and she does not expect that this difference will have a significant impact on the result (Jofre-Bonet, 2000). Recall that 90% of VHIs in Sweden are employer-paid or purchased as a group plan (Insurance Sweden, 2023). Jofre-Bonet's approach might therefore not be suitable to analyze the Swedish market. If there are differences in drivers of demand depending on the origin of the insurance, these differences should be accounted for in a more dynamic analysis of the market.

Studies that have investigated employer incentives to provide VHI have found that waiting time is a common driver for demand, similar to individual incentives (Valtonen, Kempers and Karttunen, 2014; SAHCSA, 2020). The employers' organization Confederation of Swedish Enterprise (2021) conducted a survey regarding the reasons for employers to provide VHI. Several of the companies stated reasons for providing VHI to their employers that can be connected to waiting time for healthcare. The risk- and time of sick leave, securing the business operations, and survival of the company are such reasons. However, in these same studies where waiting time can be related to employer demand for VHI, other determinants, that are not as clearly related to waiting time for healthcare, are also found. These determinants are the responsibility for rehabilitation, securing a good work environment, and facilitating the company to meet the legal requirements of occupational healthcare (Valtonen, Kempers and Karttunen, 2014; SAHCSA, 2020; Confederation of Swedish Enterprise, 2021). Employer incentives are further investigated by Tynkkynen et al. (2018) in the explorative study of the VHI market in the Nordics. They argue that once a VHI market is established, the demand is more related to cultural factors than the quality difference between private and public healthcare. An example of such a cultural factor that is connected to the employer-provided VHI is when employers offer VHI to their employees and thereby are perceived as good employers. This indicates that waiting time is important in the decision for employers but that there are other drivers of demand that do not apply to individually purchased VHI.

Besley, Hall and Preston (1999) investigates the impact waiting time has on demand for VHI and also controls for the different mechanisms of employer-purchased and individually purchased VHI. The results of this United Kingdom study indicate that long-term waiting lists increase the likelihood of purchasing a VHI, independent of the origin of the insurance.

However, the effect was larger for the individually purchased VHI, which implies that employer-provided VHI is less sensitive to inflexibilities in the public sector. In a similar study in Norway, Aarbu (2010) found the same relationships for individually purchased VHI. However, he did not find a significant effect for employer-purchased insurance as Besley, Hall and Preston (1999) did. One limitation of both these studies is the potential problem of simultaneity causality. Our study faces the same potential simultaneity causality and in order to mitigate the bias we follow the approach of Aarbu (2010) by including lagged values of waiting time. Even though previous studies have investigated this in other markets with similar healthcare systems, it is important to consider the context of the specific market. Additionally, to the best of our knowledge, the last study made is the one by Aarbu (2010) who uses VHI data from 2004. The generalizability of previous studies to the Swedish market today can therefore be considered low, and we aim to fill this gap in the literature. This study provides evidence of the relationship between waiting time in healthcare and the demand for VHI in Sweden while taking the origin of the insurance into account.

3 Theoretical Framework

The decision for an individual to purchase a VHI, and the decision for an employer to provide a VHI, can be theorized using expected- utility and profit theory. The theoretical framework is based on Besley, Hall and Preston (1999) and Jofre-Bonet (2000). In expected utility theory the consumer wants to maximize their expected utility and weighs the expected benefits and cost of a VHI against the benefits and costs of not having a VHI. We are providing two separate theories. First, a theory of the willingness to pay for individual VHI is presented in 3.1. Secondly, the theory of the willingness to pay for employer-paid VHI is presented in 3.2. The second theory is a combination of expected utility and profit theory that captures demand for employer-paid VHI. Remember, a consumer can also obtain VHI as a group plan. This decision is not considered in the theoretical section due to the complex nature of the combination of individual-, employer- and union incentives. It is however included in the empirical analysis.

3.1 Willingness to pay for individual VHI

In the first theoretical approach, a consumer faces the risk of illness with a probability of $\theta \in [0, 1]$. To recover, the individual consumes one unit of treatment q. Treatment varies at a quality level, $q \in [\underline{q}, \overline{q}]$. Since the VHI market in Sweden is a competitive market, an individual with a VHI chooses private healthcare with the highest quality, $\overline{q}$, which comes at a cost, ρ, for the insurance company. An individual without a VHI uses the public healthcare system with the quality Q. The out-of-pocket payment for public healthcare is between 100 and 400 SEK (SALAR, 2022) and is denoted as Φ.

The typical consumer has a utility function $U(Y)$ when healthy. The utility is a function of the net income of the person and is increasing and concave. $u(q, Y)$ is the utility function of the consumer in the case of illness where q is the level of care they receive. This function is also increasing and concave in Y and increasing in q. This ensures that the quality of the treatment is a normal good which is empirically supported by Besley, Hall and Preston (1999).

We expect little ex-ante moral hazard on the Swedish market since 85% of the VHIs require a deductible (SAHCSA, 2020) which ranges from 500 to 1,500 SEK per illness (Swedish Ministry of Social Affairs, 2021). This implies that a consumer has income y, and with a VHI would pay both the insurance premium, μ, and a deductible, σ, in case of illness. The equilibrium premium can be rewritten as, $\mu = \theta\beta\rho\overline{q}$, where β is a multiplicative. A multiplicative larger than one indicates administrative costs or markup for the insurance company. The four utility functions 3.1-3.4 are derived as:

The utility of a healthy individual with a VHI:

$$U(y - \theta\beta\rho\overline{q}) \tag{3.1}$$

The utility of an ill individual with a VHI, using private healthcare:

$$u(\overline{q}, y - \theta\beta\rho\overline{q} - \sigma) \tag{3.2}$$

The utility of a healthy individual without VHI:

$$U(y) \tag{3.3}$$

The utility of an ill individual without VHI, using public healthcare:

$$u(Q, y - \Phi) \tag{3.4}$$

The consumer determines the decision to purchase insurance by comparing the following two expected utility functions that include a fixed probability of illness, θ:

$$V^{VHI}(\theta, y, \beta, \rho, \overline{q}, \sigma) = \theta u(\overline{q}, y - \theta\beta\rho\overline{q} - \sigma) + (1 - \theta)U(y - \theta\beta\rho\overline{q}) \tag{3.5}$$

$$V^{Public}(\theta, Q, y, \Phi) = \theta u(Q, y - \Phi) + (1 - \theta)U(y) \tag{3.6}$$

A consumer will purchase a VHI if the expected utility of having a VHI is at least as large as if they would not have it. Thus, they would only purchase a VIH if:

$$V^{VHI}(\theta, y, \beta, \rho, \overline{q}, \sigma) \geq V^{Public}(\theta, Q, y, \Phi) \tag{3.7}$$

In a model where all variables except income are fixed at a given level, there exists a value of income $\hat{y} \in [\underline{y}, \overline{y}]$ where an individual consumer is indifferent between a VHI and the public healthcare system.

The threshold level of income can be seen in the following equation, where the expected utility of having a VHI equals the expected utility of using the public healthcare system:

$$\theta u(\overline{q}, \hat{y} - \theta\beta\rho\overline{q} - \sigma) + (1 - \theta)U(\hat{y} - \theta\beta\rho\overline{q}) = \theta u(Q, \hat{y} - \Phi) + (1 - \theta)U(\hat{y}) \tag{3.8}$$

By differentiating the expected utility functions with respect to income, the left-hand side of equation 3.8 is growing at a faster rate than the left-hand side.

$$\theta u_y(\overline{q}, \hat{y} - \theta\beta\rho\overline{q} - \sigma) + (1 - \theta)U_y(\hat{y} - \theta\beta\rho\overline{q}) > \theta u_y(Q, \hat{y} - \Phi) + (1 - \theta)U_y(\hat{y}) \tag{3.9}$$

Thus, individuals with an income over $\hat{y}$, will have a higher utility of having a VHI than if they were to use the public healthcare system. This holds because $U(Y)$ and $u(q, Y)$

are concave in net income and have a positive cross derivative. Due to the diminishing marginal utility of net income, the loss in utility caused by the premium is decreasing with income.

The theory implies that a lower quality of public healthcare increases the demand for VHI. Income is associated with an increase in utility for both private- and public healthcare. For a given threshold level of income, an increase in income is associated with a higher utility of using private healthcare compared to the public. The premium has a negative association with the demand. Since the multiplicator has a negative association it implies that a discount will increase the consumer's probability of buying a VHI. The deductible has a negative association with the expected utility of having a VHI and the out-of-pocket (OOP) payment has a negative association with the expected utility of not having a VHI. An increased deductible would therefore lead to a decrease in demand for VHI while an increased OOP payment would lead to an increase. The health status and risk of illness also have an impact. However, the effect of the probability of illness is unclear. If the probability of being ill is high, the incentive for the consumer to get a VHI increases but at the same time the premium increases which would decrease demand.

3.2 Willingness to pay for employer-provided VHI

3.2.1 Expected profit theory

In the second theoretical approach, the demand for employer-paid VHI is derived. Thus, two perspectives must be considered, the employer's and the individual's. The first perspective to consider is the profit function an employer faces. The equilibrium premium ($\theta\beta\rho\overline{q}$), the risk of illness ($\theta$), and the private and public treatment quality ($\overline{q}$ & Q) have the same attributes as in the previous part of the theory. We assume that the employer fully covers the premium if they offer VHI to its employees.

A typical company has a profit function $\pi(R)$ when the employee is healthy. The profit is a function of the company's net revenue and is increasing and concave. $\pi(q, R)$ is the profit function of the company in case of the employee getting ill where q is the level of care the employee receives. The revenue of the company is denoted by r. The four profit functions 3.10-3.13 are derived as:

The profit of a company that provides VHI and the employee is healthy:

$$\Pi(r - \theta\beta\rho\overline{q}) \tag{3.10}$$

The profit of a company that provides VHI and the ill employee is using private healthcare:

$$\pi(\overline{q}, r - \theta\beta\rho\overline{q}) \tag{3.11}$$

The profit of a company who do not provide VHI and the employee is healthy:

$$\Pi(r) \tag{3.12}$$

The profit of a company who do not provide VHI and the ill employee is using public healthcare:

$$\pi(Q, r) \tag{3.13}$$

The employer evaluates the decision to provide insurance to the employee by comparing the following two expected profit functions that include a fixed probability of illness, θ, for the employee:

$$P^{VHI\ Employer}(\theta, r, \beta, \rho, \overline{q},) = \theta\pi(\overline{q}, r - \theta\beta\rho\overline{q}) + (1 - \theta)\Pi(r - \theta\beta\rho\overline{q}) \tag{3.14}$$

$$P^{Public}(\theta, Q, r) = \theta\pi(Q, r) + (1 - \theta)\Pi(r) \tag{3.15}$$

The employer will provide the employee with a VHI if the expected profit of providing a VHI is at least as large as if they would not provide it. Thus, they would only provide a VIH if:

$$P^{VHI\ Employer}(\theta, r, \beta, \rho, \overline{q},) \geq P^{Public}(\theta, Q, r) \tag{3.16}$$

This theory has many similarities with the expected utility theory in 3.1. For example, a decreasing quality of public healthcare increases the employer demand for VHI. The demand is decreasing with the premium. Equally to how income affects individual demand, revenue

affects employer demand. At a given threshold value of revenue, an increase is associated with a higher demand for providing a VHI compared to not providing one.

3.2.2 Expected utility theory

The second perspective is the expected utility functions the employee has to consider if the employer offers a VHI. The difference in the choice the consumer faces when the insurance is offered by their employer compared to if they were to purchase it individually is the absence of the insurance premium.

The utility of a healthy person with an employer-paid VHI:

$$U(y) \tag{3.17}$$

The utility of an ill person with an employer-paid VHI:

$$u(\overline{q}, y - \sigma) \tag{3.18}$$

The utility of a healthy person without an employer-paid VHI:

$$U(y) \tag{3.19}$$

The utility of an ill person without an employer-paid VHI, using public healthcare:

$$u(Q, y - \Phi) \tag{3.20}$$

The consumer determines the decision to accept employer-paid insurance by comparing the following two expected utility functions that include a fixed probability of illness, θ:

$$V^{VHI\ Employer}(\theta, y, \sigma) = \theta u(\overline{q}, y - \sigma) + (1 - \theta)U(y) \tag{3.21}$$

$$V^{Public}(\theta, Q, y, \Phi) = \theta u(Q, y - \Phi) + (1 - \theta)U(y) \tag{3.22}$$

A consumer accepts the VHI from the employer if the expected utility of having a VHI is at least as large as if they would not have it. Thus, they would only accept the VHI if:

$$V^{VHI\ Employer}(\theta, y, \sigma) \geq V^{Public}(\theta, Q, y, \Phi) \tag{3.23}$$

We can conclude that the employee bases their decision on similar information for employer-paid insurance as if they purchase it individually. The difference is that the employee does not pay the premium. Thus, the employee solely bases their decision on the quality of private- and public healthcare, the deductible, the OOP payment, and the income. As for the income, the same mechanism is applied in this case as in the expected utility theory in 3.1.

4 Hypotheses

Based on the theory and previous literature, three hypotheses are tested in this study. The first hypothesis is connected to the first research question and the latter two are connected to the second research question.

1. Waiting time in specialist healthcare is positively associated with demand for voluntary health insurance.

As illustrated in the theory, if the quality of public healthcare decreases, the expected utility of using the public healthcare system does the same. This could cause the expected utility of having a VHI to be larger than not having it. The relationship has been found in previous studies in other countries and this study explores the relationship in Sweden.

2. Waiting time has a stronger association with demand for voluntary health insurance if the insurance is purchased individually than if it is employer-paid.

For a person to get VHI provided by their employer, the employer must have a larger expected profit from providing the insurance than not. The individual then considers the expected utility of having the insurance versus not having the insurance. The theory states that the quality and the cost of healthcare are the main focus for both the individual and the employer. According to Besley, Hall and Preston (1999) and Aarbu (2010), demand for employer-provided insurance is less sensitive to waiting time than demand for individually

purchased insurance. The literature additionally describes that employers also consider cultural factors such as being seen as a good employer or providing VHI as a means to meet the legal requirements of occupational healthcare. Since the employer has additional incentives that the individual consumer does not have, the hypothesis is that waiting time is less of a determining factor on demand for employer-paid VHI.

3. Waiting time has a different association with demand for voluntary health insurance depending on if the insurance is purchased as a group plan or from another origin.

Since the demand for a group plan consists of individual-, employer- and union incentives, the same reasoning as for hypothesis two is applied to individuals and employers. However, the literature and theory do not provide any insights on union incentives to provide VHI. The association between waiting time and the demand for group plan insurance is therefore uncertain. The relationship will be tested and compared to the association between waiting time and the other origins of insurance.

5 Data and Method

5.1 Data

To answer the research questions a novel dataset is constructed by combining individual-level data on VHI coverage and regional-level data on waiting time. Data from the survey Riks-SOM 2016 is used for the dependent variables of VHI coverage and the covariates of individual- and occupational characteristics. Regional information on waiting time is provided by SALAR. The data is further presented in the following sub-sections.

5.1.1 Riks-SOM

Riks-SOM is a Swedish nationwide survey that collects information on the attitudes and habits of Society, Opinion, and Media and it has been conducted yearly since 1986. Questions regarding VHI were solely included in questionnaire four from Riks-SOM 2016 and were not included in other years. In the survey from 2016, individuals with and without Swedish citizenship were eligible in the selection process if their primary address was in Sweden. The

way of participating in the survey was primarily through answering postal surveys on paper but it was also available to answer online. Apart from information on VHI, the survey also includes information on individual- and occupational characteristics which are used as covariates in the econometric models. The questionnaire was sent out to 3,400 randomly selected individuals between the ages of 16 and 85. 1,636 individuals responded to the survey which corresponds to a response rate of 48% (Bové, 2016). People under the age of 20 do not pay an OOP payment when seeking public healthcare in a majority of the Swedish regions (1177, 2023). Due to the lack of variation of VHI holding status in the observations between the ages of 16 and 19, the study is limited to analyzing the population between 20 and 85 years.

The main advantage of using data from the Riks-SOM 2016 survey for this study, despite the lack of a panel structure, is that it allows us to observe the origin of the insurance and individual characteristics that could impact the decision to purchase a VHI. There are also questions in the survey that provide information on the workplace of the respondent. However, information such as the size or revenue of the employer, which could be of importance when estimating employer demand, is not included in the survey. This could impact how well the employer demand is captured and must be considered when evaluating the results.

5.1.2 Dependent variables

The four dependent variables are constructed based on the Riks-SOM 2016 survey. There were two questions about voluntary health insurance in the survey. The first question was: "Do you have private healthcare insurance that gives you access to private healthcare". This question had three choice alternatives 1a) "Yes", 1b) "No", and 1c) "Do not know" (SOM Institute, 2016)[1]. Due to the nature of the research questions of this study, the sample is limited to solely include observations that either have or do not have a VHI. The data is used to construct the dependent variable in order to answer the first research question: Does waiting time in healthcare impact demand for voluntary health insurance in Sweden?

1. VHI - Observation has VHI

[1]The questions are translated from Swedish to English by the authors of this study.

The follow-up question in the survey was: "If yes, how is your private healthcare insurance financed?". This question had three choice alternatives 2a) "My employer pays the premium", 2b) "I have healthcare insurance through employer or union, I pay the premium myself", and 2c) "I have individual healthcare insurance, I pay the premium myself" (SOM Institute, 2016). Due to the structure of the data, the responses to question 2a and 2b does not allow us to observe if an employer or a union has offered a VHI to an employee or member. Rather, we can solely observe if such an offer has been accepted. For question 2b), the data does not entail whether it is a union or employer that has provided the insurance. Consequently, the types of demand captured in question 2a are employer- and individual demand, in 2b employer, union- and individual demand, and in 2c it is individual demand. According to empirics from other countries and theory, the magnitude of the effect waiting time has on demand differs depending on the origin of the VHI. In the second research question, the area of interest is the impact of waiting time, dependent on the origin of the VHI. The following dependent variables are constructed to answer the second research question: Does waiting time in healthcare impact demand for voluntary health insurance differently, depending on the origin of the insurance?

2. $VHI^{Individual}$ - Individually purchased VHI
3. $VHI^{Employer\text{-}paid}$ - Employer-paid VHI
4. $VHI^{Group\ Plan}$ - Group plan

The survey data on VHI is self-reported and there are limited ways of controlling if the respondent answered in accordance with their actual VHI status. As there are two questions regarding VHI in the survey it is possible to control for some inattention by examining inconsistency in the answers. Out of those who answered that they do not have (or do not know if they have) private health insurance, there were some that still answered the second question on who finances their VHI. As these answers are contradictory, these observations are excluded from the study to increase the reliability. Lastly, we exclude observations that have missing values on variables that are used in the probit models. After removing the observations that are inconsistent or have missing values, the final sample contains 1,106 observations.

5.1.3 Waiting time

Explanatory variables are constructed using regional data provided by SALAR, to measure the impact waiting time has on demand for VHI. To decide which healthcare domains of waiting time to include in the analysis, it is important to consider how VHI can benefit insurance takers in terms of waiting time.

An analysis of the insurance plans of the seven largest insurance companies in Sweden by Kullberg, Blomqvist and Winblad (2019) shows that the companies offer different degrees of benefits in the basic-, standard- and comprehensive insurance plans. Examples of benefits in the standard- and comprehensive plans are sessions with a physiotherapist or chiropractor, vaccinations, and addiction treatment. In the standard and comprehensive plans, the benefits have a larger variation between the insurance companies compared to the basic plans. This variation cannot be controlled for and the waiting time variables are therefore based on what is included in the basic insurance plans.

Benefits that are included in all of the basic plans are care coordination, outpatient medical care, and medical surgery. The care coordinator helps the insurance holder to navigate the healthcare system by booking appointments and finding suitable healthcare providers. Outpatient medical care includes both visits to general practitioners and specialist services (Kullberg, Blomqvist and Winblad, 2019). The healthcare guarantee for public primary care was strengthened in 2019 when the guaranteed appointment decreased from 7 to 3 days (Swedish Ministry of Social Affairs, 2020). The guaranteed waiting time to see a general practitioner when having a VHI is comparable to the public sector waiting time. Therefore this study solely bases the waiting time measurements on specialized healthcare.

Kullberg, Blomqvist and Winblad (2019) further state that there are typically a number of outpatient services that are not included in the basic plans. One of these exclusions is acute care which is therefore not included in the waiting time measurements in this study. Other services are treatments for rare diseases and complications related to obesity and substance abuse. Even though these treatments are typically not in the scope of a VHI, these remain in the specialist waiting time measurements since the data does not allow for the exclusion

of waiting time to these specific types of treatments. This would only lead to biased results if there are structural differences between regions. We expect that these services constitute a negligible part of the total healthcare services provided in healthcare and the potential bias should therefore not have a significant impact on the results.

To conclude, the measurements consist of data on waiting time in specialized healthcare, excluding acute care. In order to calculate the average marginal effects of waiting time on different levels of waiting time it would have been beneficial if the measurement were in average waiting time in days. This type of data is not available and in order to capture the impact of different lengths of waiting time, three time frames are examined. To investigate if there are any differences between the impact of waiting time to a first visit and waiting time for surgery or other treatment, six separate measurements are constructed.

- Waiting time to visit - The share of patients that have not gotten a first visit in specialist healthcare within 90, 60, and 30 days.
- Waiting time to surgery - The share of patients that did not get surgery or other treatment in the in- & outpatient specialized healthcare within 90, 60, and 30 days.

The waiting time data includes both publicly- and privately-provided care. All of the public, and a majority of the private healthcare providers, supply information to the database (SALAR, 2022). If there are regional structural differences in the attrition of waiting time data reporting from private healthcare providers it would create bias in the results. SALAR (2023) does however report that for the measurement of specialized healthcare, there is a high reporting rate of 95-100% and that there is little variation between the regions. The attrition of some private healthcare providers should therefore not impact the result to a substantial extent. It would have been beneficial if it was possible to separate the waiting times in public healthcare from the waiting times of the patients that are seeking care through VHI but it is not possible through the data available. The measurement could introduce bias if there are regional structural differences in what proportion of the patients seek healthcare through a VHI and what proportion seek healthcare publicly.

Even though the survey data is from 2016, the waiting time variables constitute of the average yearly waiting time between 2010 to 2013. It is possible that individuals' perceptions of waiting time have formed over a longer period, rather than at one moment. Additionally, by including several years the potential persisting effect of waiting time is captured. The data does not include information on when the insurance is obtained. Therefore it is not possible to determine what exact waiting time the consumer faced when making the decision to obtain a VHI. With an increased time frame the probability of capturing the waiting time the consumer faced is higher. If this measure is highly affected by waiting time that the consumer did not face, the results would be biased. Data on waiting time provided by SALAR is solely accessible from 2009 forward. However, the attrition in the data from 2009 amounts to 18%, and is often region specific.[2] Therefore waiting time from 2009 is not included. There is an attrition of 5% in waiting time from 2010, although it does not appear to be systematic. A robustness test where only data on waiting time from 2011-2013 is used to illustrate if the model is robust to changes in the time frame. By excluding the years 2014-2016, the problem of simultaneity bias is mitigated. This method to mitigate simultaneity bias is based on Aarbu (2010) and is further elaborated on in section 5.2.2.

It is worth mentioning that since the waiting time data is on a regional level, we assume that everyone within a region faces the same waiting time. If there is heterogeneity of waiting time present within the region, it is not accounted for in this study.

5.1.4 Covariates

The models include covariates that we find likely to have an association with having a VHI. These could be related to health status and other factors that impact the demand for healthcare. To provide more precise estimates and decrease the risk of omitted variable bias we include covariates of individual- and occupational characteristics from the Riks-SOM 2016 survey. Individual characteristics that are controlled for are gender, age, political orientation, income, education, number of adults in household, self-perceived health status, and exercise- and alcohol habits. To capture how individual demand differs from employer- and union demand,

[2] E.g. Kalmar had an attrition rate of 89% in 2009.

it is also important to consider the employer and union incentives and how they relate to VHI and waiting time. The occupational characteristics that are controlled for are self-employment, unemployment, blue-collar worker, public sector worker, and union membership. More detailed specifications of the covariates are found in Table 5.2-5.3 and in Appendix B.

A delimitation, due to the scope of this study, is that the covariates do not consider the supply side. It is possible that the demand for VHI differs depending on the supply of private healthcare. A consumer in a region with a low number and a low diversity of private healthcare providers ought to have less benefit from purchasing a VHI than a consumer in a region with a high number and a high diversity of private healthcare providers. If there are systematical differences between the regions in the level of private healthcare providers per capita, we do not consider the potential omitted variable bias.

5.1.5 Non-response and post-stratification weights

The sample of questionnaire four in Riks-SOM 2016 is not exempted from non-response. This group consists of individuals that were not able to or chose not to participate in the survey. The non-response consists of a total of 1,764 individuals, resulting in a 52% non-response rate. Despite that more than half of the sample did not participate in the survey, the sample is considered representative of the Swedish population in most regards. However, younger individuals and men are underrepresented in the responses (Bové, 2016). This sample selection bias could impact the validity of the result. To mitigate the bias, population post-stratification weights are applied. Due to the importance of regional variation in this study we, in addition to age and gender, also investigate if weights should be applied to regions.

Post-stratification weights are a method used to adjust the sample to be more representative of the population. This is done by creating weights for the undersampled and oversampled sub-populations, which results in a sample that better represents the true population. To create post-stratification weights it is necessary to know the true population proportion (DeBell and Krosnick, 2009). Statistics Sweden (2023a) provides data on ages, gender, and regional population size which is aggregated from individual data from the national registration system.

To increase the credibility of the weight, we compare the true population with the sample population. A chi-squared test is appropriate to compare two populations and determine if the respondents of the survey resemble the population of interest. If the result from the chi-squared is significant the null hypothesis of no association between the two populations can be rejected. If the null hypothesis fails to be rejected the sample is disproportionate and post-stratification weights can be applied to solve for the bias (Royal, 2019).

The three chi-squared tests are presented in Table 9.1 in Appendix B. The result indicates that the survey sample is disproportionate in age and gender, which is in line with the findings of Bové (2016). The chi-squared test also shows that the regional population size in the sample is representative of the true population. We do therefore not proceed with post-stratification weights for regions. To accurately represent the population, the weights are adjusted to fit the observations included in each regression. The weights for age and gender are calculated as follows and the final weights are presented in Table 9.2 in Appendix B:

$$Post\text{-}stratification\ weight = \frac{Population\ Proportion}{Completed\ Survey\ Proportion} \tag{5.1}$$

Counter-intuitively, post-stratification weights might further bias the results. The method does not add a limit to the lowest and highest weight values. If there are extreme values in the weights, one solution is weight trimming. By trimming the weights, the sampling variance is reduced and leads to a lesser sensitivity to outliers (Battaglia, Hoaglin and Frankel, 2009). To determine if weight trimming should be applied, three different methods by de Kerckhove, Mohadjer and Krenzke (2014) are used. The results imply that no trimming is necessary. The results of the tests are presented in Table 9.3-9.5 in Appendix B.

5.1.6 Descriptive statistics

The descriptive statistics of VHI uptake are presented in Table 5.1, which shows that 16.4% of the sample holds a VHI. For the different origins, we can see that individual VHI consists of 4.7%, employer-paid consists of 8.2% and group plan consists of 4% of the sample. The standard deviation shows that there is a greater variation for VHI than for the different origins, which is a natural consequence of the larger sample of VHI holders.

Table 5.1: Descriptive Statistics of Dependent Variables

Variables	**Obs.**	**Mean**	**Std. Dev.**	**Min**	**Max**
VHI	1,106	0.164	0.370	0	1
$\text{VHI}^{Individual}$	1,106	0.047	0.211	0	1
$\text{VHI}^{Employer\text{-}Paid}$	1,106	0.082	0.275	0	1
$\text{VHI}^{Group\ Plan}$	1,106	0.040	0.196	0	1

Note: Gender- and age population adjusted post-stratification weights are applied.

Descriptive statistics for the waiting time variables and the individual and occupational characteristics are presented in Tables 5.2 and 5.3. When observing the waiting time to first visit variables, the mean is slightly larger for those who hold a VHI than for those who do not. For the waiting time to surgery variables the group that has the largest average differs depending on the time frame. Further, the difference in the mean of the age group 65+ between the group with- and without a VHI shows that the proportion of this age group is larger in the group who does not have a VHI. There is also a difference between the groups regarding household income. For the group with VHI, the mean of lower household income is smaller and the mean of higher household income is larger than for the group without VHI. Those with a self-reported excellent health status have a larger mean in the group with a VHI than in the group without. There are also some differences in the means of the groups for the occupational characteristics. For example, in the group with VHI, the mean is larger for self-employed while it is smaller for public sector workers. A more detailed presentation of the regional variation of VHI holding status and waiting time is presented in Table 9.15-9.16, in Appendix B.

Table 5.2: Variable Description and Descriptive Statistics

		Without VHI					With VHI				
Variables	**Description**	**Obs.**	**Mean**	**SD**	**Min**	**Max**	**Obs.**	**Mean**	**SD**	**Min**	**Max**
Waiting Time											
First visit: 90 days	The share of patients that have not gotten a first visit in specialist healthcare within 90 days	925	11.14	3.53	4.90	18.39	181	11.60	3.28	4.90	18.39
First visit: 60 days	The share of patients that have not gotten a first visit in specialist healthcare within 60 days	925	22.68	4.58	15.71	32.86	181	23.13	4.18	15.71	32.86
First visit: 30 days	The share of patients that have not gotten a first visit in specialist healthcare within 30 days	925	48.74	6.22	40.74	61.87	181	48.89	6.28	40.74	61.87
Surgery: 90 days	The share of patients that did not get surgery or other treatment in the in- & outpatient specialized healthcare within 90 days	925	23.72	4.26	16.97	35.88	181	23.65	4.22	17.77	35.88
Surgery: 60 days	The share of patients that did not get surgery or other treatment in the in- & outpatient specialized healthcare within 60 days	925	33.45	5.70	24.95	48.24	181	33.38	5.64	25.89	48.24
Surgery: 30 days	The share of patients that did not get surgery or other treatment in the in- & outpatient specialized healthcare within 30 days	925	54.93	5.25	46.63	68.10	181	54.88	5.15	47.28	68.10
Individual Characteristics											
Age 20s	Equal to 1 if the respondent's age is between 20 and 29	925	0.19	0.39	0	1	181	0.17	0.38	0	1
Age 30s	Equal to 1 if the respondent's age is between 30 and 39	925	0.16	0.36	0	1	181	0.24	0.43	0	1
Age 40s	Equal to 1 if the respondent's age is between 40 and 49	925	0.15	0.36	0	1	181	0.26	0.44	0	1
Age 50-65	Equal to 1 if the respondent's age is between 50 and 65	925	0.24	0.43	0	1	181	0.25	0.44	0	1
Age 65+	Equal to 1 if the respondent's age is over 65	925	0.26	0.44	0	1	181	0.08	0.27	0	1
Female	Equal to 1 if the respondent is female	925	0.51	0.50	0	1	181	0.46	0.50	0	1
Lower Household Income	Income of the respondent, where 1 equals household income below 300,000 SEK	925	0.25	0.43	0	1	181	0.05	0.22	0	1
Higher Household Income	Income of the respondent, where 1 equals household income above 700,000 SEK	925	0.27	0.44	0	1	181	0.60	0.49	0	1

Note: Gender- and age population adjusted post-stratification weights are applied.

Table 5.3: Variable Description and Descriptive Statistics

		Without VHI					With VHI				
Variables	**Description**	**Obs.**	**Mean**	**SD**	**Min**	**Max**	**Obs.**	**Mean**	**SD**	**Min**	**Max**
Individual Characteristics (cont.)											
More than one adult in household	Respondent household, where 1 equals living with at least another adult	925	0.72	0.45	0	1	181	0.79	0.41	0	1
Lower Education	Respondents level of education, where 1 equals unfinished high school studies or lower	925	0.18	0.39	0	1	181	0.08	0.28	0	1
Higher Education	Respondents level of education, where 1 equals university degree	925	0.61	0.49	0	1	181	0.71	0.46	0	1
Politically Left	Political orientation of the respondent, where 1 equal orientation to the left of the political spectra	925	0.36	0.48	0	1	181	0.22	0.42	0	1
Politically Right	Political orientation of the respondent, where 1 equal orientation to the right of the political spectra	925	0.35	0.48	0	1	181	0.55	0.50	0	1
Excellent Health	Respondents self-perceived health status, where 1 equals excellent health status	925	0.33	0.47	0	1	181	0.48	0.50	0	1
Exercises Weekly	Excersise habits, where 1 equal respondent works out at least once a week	925	0.67	0.47	0	1	181	0.75	0.43	0	1
Drinks Alcohol Regularly	Alcohol habits, where 1 equal respondent drinks alcohol several times a week	925	0.10	0.30	0	1	181	0.08	0.28	0	1
Occupational Characteristics											
Self-employed	Equal to 1 if respondent is self-employed	925	0.07	0.26	0	1	181	0.21	0.41	0	1
Blue Collar	Equal to 1 if respondent is a blue collar worker	925	0.42	0.49	0	1	181	0.21	0.41	0	1
Unemployed	Equal to 1 if respondent is unemployed	925	0.04	0.20	0	1	181	0.01	0.10	0	1
Public Sector	Equal to 1 if respondent works in the public sector	925	0.46	0.50	0	1	181	0.16	0.37	0	1
Union Member	Equal to 1 if the respondent is a union member	925	0.58	0.49	0	1	181	0.64	0.48	0	1

Note: Gender- and age population adjusted post-stratification weights are applied.

5.2 Method

The dependent variables are binary which requires a model that accounts for this. We assume that the response probability of waiting time is non-linear, thus a linear probability model, that assumes constant marginal effects, is not suitable. A possible effect on demand for VHI is not likely to be independent of the size of the waiting time. For example, it is possible that consumers accept that the region cannot live up to the healthcare guarantee of 90 days to a certain degree. However, at some point, the consumers no longer accept the share of patients that do not get care within the guaranteed time. Thus, it is reasonable to believe that a small- and a large share do not have the same effect on demand. Previous studies have used non-linear models to estimate the relationship (Besley, Hall and Preston, 1999; Jofre-Bonet, 2000; Aarbu, 2010). Therefore, a probit regression model, with a cumulative standard normal distribution function is suitable to use. To investigate whether the results are sensitive to the model specification, linear probability models are run as a robustness test.

The probit model has its clear non-linear advantage. However, one disadvantage of this model is that the estimated coefficients cannot be interpreted directly by themselves, only the sign can be interpreted (Verbeek, 2012). To provide interpretable results, in terms of average marginal effects of the impact waiting time has on demand for VHI, average marginal effects are evaluated. The covariates are fixed at their average values and therefore the estimated effects are representative of a respondent with mean characteristics.

5.2.1 Econometric model

To estimate the impact of demand for VHI and how it differs depending on the origin of the insurance, four dependent variables and six waiting time variables are used. This results in a total of 24 regression models. The demand, independent of origin, is investigated in Model 1 and takes the following form:

$$Pr(VHI_{ij} = 1|WT_j, X_{ij}, O_{ij}) = \Phi(\beta_0 + \beta_1 WT_j + \beta_3 \mathbf{X}_{ij} + \beta_4 \mathbf{O}_{ij} + \epsilon_{ij}) \quad (1)$$

The probit Model 1 estimates the probability that an observation has a VHI. The independent variable of interest is waiting time. Waiting time to first visit and waiting time to

surgery in 90, 60, and 30 days varies between regions and are estimated separately in different regressions. Individual characteristics (**X**) and occupational characteristics (**O**), which vary on an individual and regional level are included in the model. Lastly, an error term (ϵ) is included.

In order to estimate how the demand for VHI differs depending on the origin of the insurance, three additional models are estimated.

$$Pr(VHI_{ij}^{Individual} = 1|WT_j, X_{ij}, O_{ij}) = \Phi(\beta_0 + \beta_1 WT_j + \beta_3 \mathbf{X}_{ij} + \beta_4 \mathbf{O}_{ij} + \epsilon_{ij}) \quad (2)$$

$$Pr(VHI_{ij}^{Employer\text{-}paid} = 1|WT_j, X_{ij}, O_{ij}) = \Phi(\beta_0 + \beta_1 WT_j + \beta_3 \mathbf{X}_{ij} + \beta_4 \mathbf{O}_{ij} + \epsilon_{ij}) \quad (3)$$

$$Pr(VHI_{ij}^{Group\ Plan} = 1|WT_j, X_{ij}, O_{ij}) = \Phi(\beta_0 + \beta_1 WT_j + \beta_3 \mathbf{X}_{ij} + \beta_4 \mathbf{O}_{ij} + \epsilon_{ij}) \quad (4)$$

In Model 2, the probability that an observation has individually purchased VHI is estimated. There is a possibility that individual preferences of occupation do impact the likelihood of purchasing a VHI through other channels than the individual covariates. The occupational characteristics might impact individual demand and are therefore included in Model 2. Model 3, estimates the probability that a respondent has been offered and accepted an employer-paid VHI. If the employer sees the benefit of avoiding waiting time, the individual consumer should see it too since they, according to the literature, are more sensitive to waiting time. Thus, the inability to observe the structural employer demand is not a large problem for this study. Lastly, model 4 estimates the probability that a respondent has been offered a group plan and accepted it. A consumer ought to have low incentives to have multiple insurances. In the respective model, the observations that have another type of VHI are excluded. For example, observations with individually purchased- and group plan VHI are removed from the model of employer-paid VHI, which results in a lower number of observations in models 2-4 compared to model 1. If these observations were not excluded, the relationship between waiting time and VHI might be underestimated.

5.2.2 Simultaneity causality

The model specifications potentially suffer from the endogeneity problem of simultaneity causality where waiting time impacts the demand for VHI, and at the same time, the demand for VHI impacts waiting time. Scandinavian studies have found that individuals with a VHI use public healthcare less than those without (Søgaard, Pedersen and Bech, 2013; Kullberg, Blomqvist and Winblad, 2019). If fewer use public healthcare the consequence should therefore be decreasing waiting time in public healthcare. If this reversed relationship exists, we would underestimate the effect of waiting time on VHI uptake. Lapidus (2022) does however argue that an increase in the VHI uptake in Sweden would instead have a burdening effect on the public healthcare system, partly due to a loss of health professionals in the public healthcare. Intuitively, fewer health professionals in the public sector should therefore lead to longer waiting times. Depending on which effect VHI uptake has on waiting time, there is a possibility of either underestimating or overestimating the effect.

One way to mitigate the simultaneity causality is to conduct a randomized controlled experiment. However, in the scope of the study, it would not be possible to implement such a method. An alternative way to mitigate simultaneity causality is to use an instrument for the endogenous variable. To our knowledge, no previous study on the relationship between waiting time and demand for VHI has found a suitable instrument to mitigate the simultaneity bias. We have investigated potential instruments, but have not been able to identify one. Besley, Hall and Preston (1999) instead address the simultaneity bias by accounting for it in their discussion of the results where they reason that if simultaneity bias exists, they would underestimate the true relationship. Jofre-Bonet (2000) discusses the limited impact of the simultaneity bias. She argues that if one individual holds a VHI, it will have a negligible impact on the waiting time compared to how the waiting time in a region would impact the decision for one individual to get a VHI. Therefore, she concludes that the results are likely to be robust and that waiting time can be treated as exogenous. Aarbu (2010) approaches the problem by combining lagged values of waiting time and not including values from the most recent years before the survey. His study is as ours based on individual cross-sectional survey data and regional data on waiting time. By excluding the year of the survey and the two years prior when constructing the waiting

time variable, he argues that the problem of simultaneous causality is avoided. We find all these approaches to the potential bias to be satisfactory but to ensure that our model includes as little simultaneity bias as possible, the method Aarbu (2010) uses is applied. To observe how much simultaneity bias could affect the results, we include the years prior and the year of the survey as a robustness test.

6 Results

6.1 Average marginal effects

The average marginal effects for the waiting time variables from the 24 separate probit regressions are presented in Table 6.1. In the first model, the marginal effects on the probability of having a VHI are presented. Models 2-4, contain the average marginal effects on the probability of having a VHI from the following origins: (2) Individual VHI, (3) Employer-paid VHI, and (4) Group Plan. Individual and occupational covariates are included in each regression. Due to this lack of variation, the covariate unemployed is omitted from models 3 and 4. A positive and significant marginal effect of waiting time to first visit and waiting time for surgery is associated with an increase in the probability of having a VHI.

In Model (1), the aim is to capture the relationship between waiting time and the probability of having a VHI. The marginal effects for waiting time to first visit are positive and significant at the 5% significance level for 60 and 30 days while it is insignificant for 90 days. The results confirm, to some extent, hypothesis one and indicate that an increase in the share of patients that do not get a first appointment in outpatient specialist healthcare has a positive association with the probability of having a VHI. If the share of the patients who have not gotten a first visit within 60 days increases by one percentage point, the probability of having a VHI for a person with average characteristics increases by 0.5%. For the 30 days measurement, an increase of one percentage point is associated with a change in the probability of having a VHI by 0.4%. As for the waiting time for surgery measurements, none of them are statistically significant. The result indicates that there is no association between the share of patients who get surgery within 90, 60, or 30 days and the probability of having a VHI which contradicts hypothesis one.

Table 6.1: Average Marginal Effects

	(1)	(2)	(3)	(4)
VARIABLES	VHI	Individual VHI	Employer-paid VHI	Group Plan
Waiting time to first visit				
90 days	0.004	0.001	0.004*	0.001
	(0.003)	(0.002)	(0.002)	(0.002)
60 days	0.005**	0.002	0.003	0.001
	(0.002)	(0.001)	(0.002)	(0.002)
30 days	0.004**	0.002	0.001	0.001
	(0.002)	(0.001)	(0.002)	(0.001)
Waiting time to surgery				
90 days	0.001	-0.002	0.002	0.001
	(0.003)	(0.002)	(0.002)	(0.001)
60 days	0.001	-0.002	0.002	0.001
	(0.002)	(0.001)	(0.002)	(0.001)
30 days	0.000	-0.002	0.002	0.001
	(0.002)	(0.001)	(0.002)	(0.001)
Individual characteristics included	Yes	Yes	Yes	Yes
Occupational characteristics included	Yes	Yes	Yes	Yes
Observations	1,106	980	990	940

Note: Average marginal effects of the different waiting time measurements using 24 probit regressions are reported. Gender- and age population adjusted post-stratification weights are applied. Individual characteristics include: Age 20s, Age 30s, Age 50-65, Age65+, Female, Lower Household Income, Higher Household Income, More than One Adult in Household, Lower Education, Higher Education, Politically Left, Politically Right, Excellent Health, Exercises Weekly and Drinks Alcohol Regularly. Occupational characteristics include: Self-employed, Blue Collar, Unemployed, Public Sector and Union Member. The covariate Unemployed is omitted in model 3 & 4. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

To test hypotheses two and three, comparisons are made of the marginal effects of the waiting time measurements. For hypothesis two a comparison is made of models 2 and 3, and for hypothesis three a comparison is made of models 2, 3, and 4. The only significant result is found in the marginal effect of waiting time for a first visit in 90 days in model 3, the probability of having an employer-paid VHI. It is significant at the 10% level and displays that if the share of patients who have not gotten a visit within 90 days increases by one percentage point, the probability of an average person having an employer-paid VHI increases by 0.4%. Neither of the other marginal effects, including the effects of waiting time for surgery, are

statistically significant. As only one of the marginal effects statistically differs from zero, the results contradict hypotheses two and three.

6.2 Probit

To further investigate what other factors that could potentially drive the demand for VHI, the results from the probit models including all covariates are evaluated. We only present Table 6.2 which contains the results from the models with the explanatory variable: the share of patients that have not gotten a first visit in specialist healthcare within 90 days. The significance levels and signs of the coefficients are identical for a change of the waiting time variable within models, with a few exceptions. The probit regressions with other waiting time variables are presented in Table 9.6-9.10 in Appendix B. A focus is placed on the occupational characteristics as well as the covariates that are represented in the theoretical model; age, income, and health status.

There are some significant coefficients for the age variables. Compared to the reference group of individuals in their 40s, model 1 indicates that the age group 65+ has a lower probability of having a VHI. The 65+ also have a lower probability of having employer-paid VHI but there are no significant differences in the likelihood of having individual VHI or a group plan. A negative weakly significant relationship is found for people in their 30s for the probability of having individual insurance. However, the relationship for people in their 30s and the probability of having a group plan is positive and significant.

Compared to the reference group of individuals with a middle household income, individuals with low household income have a lower probability of having a VHI as presented in model 1. The low household income group also has a lower probability of having employer-paid VHI but there are no significant differences in the likelihood of having individual VHI or a group plan. The results for the high household income group suggest that, compared to the middle-income group, there is a higher probability of having a VHI, individual VHI, and employer-paid VHI, but no significant differences in the probability of having a group plan.

Table 6.2: Waiting Time to First Visit: 90 days

	(1)	(2)	(3)	(4)
VARIABLES	VHI	Individual VHI	Employer-paid VHI	Group Plan
Waiting Time to First Visit: 90 days	0.022	0.010	0.038*	0.015
Individual Characteristics				
Age 20s	0.085	0.106	-0.049	0.297
Age 30s	-0.097	-0.499*	-0.315	0.601**
Age 50-65	-0.084	-0.031	-0.163	0.075
Age 65+	-0.630***	-0.173	-1.354***	-0.296
Female	0.031	0.051	-0.052	0.034
Lower Household Income	-0.383**	-0.155	-0.867**	-0.195
Higher Household Income	0.443***	0.429**	0.741***	-0.005
More than One Adult in Household	-0.104	-0.072	-0.416**	0.298
Lower Education	0.004	0.010	0.051	0.054
Higher Education	-0.004	-0.050	0.053	0.153
Politically Left	-0.157	-0.019	0.019	-0.442**
Politically Right	0.088	0.048	0.110	-0.024
Excellent Health	0.166	0.308**	0.261*	-0.219
Exercises Weekly	0.180	0.096	0.016	0.379*
Drinks Alcohol Regularly	-0.283	-0.194	-0.236	-0.462
Occupational Characteristics				
Self-employed	0.615***	0.592***	0.691***	0.280
Blue Collar	-0.333**	-0.261	-0.437**	-0.450**
Unemployed	-0.720*	0.036		
Public Sector	-0.678***	-0.488***	-1.300***	-0.149
Union Member	0.246*	0.065	0.053	0.848***
Constant	-1.212***	-1.836***	-1.371***	-2.907***
Observations	1,106	980	990	940
Pseudo R^2	0.197	0.139	0.327	0.173

Note: Gender- and age population adjusted post-stratification weights are applied. Robust standard errors are used. *** p<0.01, ** p<0.05, * p<0.1.

The variables of excellent self-perceived health, exercises weekly, and drinks alcohol regularly do not indicate any association in model 1, the probability of having a VHI. The self-perceived excellent health does however have a positive and significant coefficient for individually purchased VHI and for employer-paid VHI. This indicates that people

with excellent self-perceived health are more likely to have an individually purchased- or employer-paid VHI than people with comparably worse self-perceived health.

Out of the occupational covariates, there are several strongly significant coefficients. The reference group for self-employed and blue-collar workers is white-collar workers. Those who are self-employed have a positive and strongly significant association with the likelihood of having all types of VHI, except for group plan where the coefficient is insignificant. Blue-collar workers have a negative and significant association with the probability of having all types of VHI except for individual VHI. As previously described, the covariate unemployed is only included in models 1 and 2. The association between being unemployed and the probability of having an VHI is negative and statistically significant while it is insignificant for the association of having an individually purchased VHI. Public sector workers are less likely than those who do not work in the public sector to have a VHI, individual- and employer-paid VHI. It is however not significant for the likelihood of having a group plan. Union membership is positive and significant for the probability of having a VHI and for the probability of having a group plan.

The pseudo R^2 is a goodness of fit measurement that shows the proportional increase in the model fit by including predictor variables (Verbeek, 2017). The pseudo R^2 is 0.327 for model 3 while it ranges from 0.139 and 0.197 in the other models. This does not mean that the other models are not as good, but only indicates the relative importance of each model's independent variables compared to only-intercept models.

6.3 Robustness tests

6.3.1 Waiting times between 2011-2013

The results from the robustness test, presented in Table 9.11 in Appendix B, where waiting time from 2010 is excluded from the average waiting time measurements give slightly different results compared to the 2010-2013 measurements. The 90 days waiting time to first visit measurement is now significant for the probability of having a VHI. The 30 days waiting time to first visit measurement is significant at a 10% level instead of a 5% level. The last difference is that the 90 days waiting time to first visit is no longer significant in the model of employer-paid

VHI. This indicates that the result is robust to a change in time frame to some extent. The insignificant result for waiting time to surgery remains, and two out of four significant marginal effects stayed significant.

6.3.2 Waiting times between 2010-2016

Potential simultaneity causality could be included in the models by adding waiting times from 2014-2016 into the average waiting time measurements. It also widens the time period for which waiting time the individuals could be basing their decision to purchase a VHI. The results, which are presented in Table 9.12 in Appendix B, do differ from the main results that solely include waiting times from 2010-2013. None of the coefficients for waiting time to first visit are significant while the share of patients that wait more than 60 and 30 days to surgery are positive and significant on a 10% level.

The change in significance level for the coefficients of waiting time to first visit is in line with Besley, Hall and Preston (1999) who argue that if simultaneity bias is present, the effect on waiting time would be underestimated. However, the positive significant association on waiting time to surgery indicates that the association is overestimated. One possible explanation would be that the simultaneity bias does not affect waiting time to first visit and to surgery in the same way.

Even though our result is in line with previous literature, to some extent, there is another possible explanation for the change in significance levels when including data from 2014-2016. Jofre-Bonet (2000) argues that waiting time can be treated as exogenous and thus no simultaneity bias would affect the result. This does however not mean that the result using data from 2010-2016 is robust. Since the structure of the data does not entail when the respondent first obtained a VHI, we can not observe which waiting time the consumer bases their decision on. The difference in the results could therefore be due to the models not capturing when the VHI was obtained and not a consequence of the presence of simultaneity bias.

6.3.3 Linear Probability Model

As discussed in section 5.2, we assume that the response probability of waiting time is non-linear. However, to test if the results are robust using a model that assumes a linear response probability, we evaluate the models with linear-probability regression. The result is presented in Appendix B, Table 9.13. The result is in line with the result of the probit model. The same marginal effects are significant but the significance levels for the waiting time to first visits measurements are at a 10% level in the LPM models while they are at a 5% level in the probit models. The results using a LPM are rather similar to those using a non-linear probability model, which is an indication that the model is robust across these two types of estimation methods.

6.3.4 Without post-stratification weights

To display how the post-stratification weights impacted the results, a robustness test where the average marginal effect without the weights is presented in 9.14 in Appendix B. The results differ from the original estimations to some extent when the post-stratification weights are not applied. The 30 days waiting time to first visit is positive and significant on a 10% level in Model 1 when not including post-stratification weights. The 90 days waiting time to first visit is no longer significant in the model of employer-paid VHI while the 30 days waiting time to first visit now is significant on a 10% level in the model for individual VHI. This suggests that the weights do impact the results to some extent.

7 Discussion

Does waiting time have an impact on demand for voluntary health insurance in Sweden? The empirical findings in this study suggest that there, to some extent, is a positive association between waiting time to a first visit in specialized healthcare and demand for VHI. Hence, declining healthcare quality (i.e. longer waiting time) has a positive association with consumers shifting into the private sector. This study examines different types of waiting time measurements and their relation to the probability of having a VHI. A positive relation between waiting time to first visit and demand for VHI was estimated for the 60- and 30-day

measurements while no association was found for the 90 days measurement. This implies that demand for VHI is not associated with the national healthcare guarantee of receiving a first visit to specialized healthcare within 90 days, while there is an association with shorter waiting times. However, when the timeframe was changed from 2010-2013 to 2011-2013, the 90 days measurement was also found to have an association with demand for VHI. This shows that the association for 30 and 60 days is robust for changes in the years of waiting time. It also highlights that the 90 days measurement has an association with demand for VHI depending on which year of waiting times are observed. Neither of the measurements of waiting time for surgery are statistically significant in model 1. This is an indication that waiting time to surgery has no association with the demand for VHI. Consumers do therefore seem to base their decision to get a VHI on waiting time to a first visit in specialized healthcare rather than the waiting time to surgery or other treatment.

The positive and significant results for waiting time to first visit are in accordance with the theoretical framework which states that a decreasing quality leads to an increased demand for VHI. The results are also in coherence with the empirical findings by Besley, Hall and Preston (1999), Jofre-Bonet (2000), and Aarbu (2010) who found positive associations between demand for VHI and waiting time. However, in this study, no associations were found for waiting time to surgery. The difference in the results between waiting time to first visit and waiting time to surgery can not be explained through the theoretical framework or the literature of this study. A possible explanation of the difference might be that patients feel as if they are "in the system" after a first visit. Hence, the anticipation associated with an upcoming treatment might be more important than the waiting time for actual treatment. The disparities should be further investigated in order to provide more knowledge on why the impact of waiting times might differ.

Does waiting time in healthcare impact demand for voluntary health insurance differently depending on the origin of the insurance? The results do not indicate that the impact waiting time has on demand for VHI differs depending on if the insurance is individually purchased employer-paid or in a group plan. Only the association between employer-paid VHI and waiting time to first visit within 90 days is statistically significant of all the average

marginal effects in models 2-4. Recall hypothesis two: Waiting time has a stronger association with demand for voluntary health insurance if the insurance is purchased individually than if it is employer-paid. The hypothesis is connected to the second research question and is based on both theory and the empirical findings by Besley, Hall and Preston (1999) and Aarbu (2010). They found that the association between waiting time and demand for VHI is larger for individually purchased insurance than it is for employer-provided. However, such a difference between the two origins is not found in this study, meaning that the results contradict hypothesis two. Also recall hypothesis three: Waiting time has a different association with demand for voluntary health insurance depending on if the insurance is purchased as a group plan or from another origin. The theory and previous literature connected to the third hypothesis, which is also connected to the second research question, do not provide any insights on union incentives to provide VHI. The empirical findings of this study indicate that the association between waiting time and demand for group plan insurance does not differ from individually purchased and employer-paid insurance. Hence, the results contradict hypothesis three.

Independent of which waiting time measurement is used, the sign and the significance of the covariates remain within models, with only a few exceptions. The empirical result indicates therefore that the covariates from the probit models are robust to a change in the waiting time variables. The theoretical framework suggests that income and the probability of illness are determinants of obtaining a VHI. Household income is found to have an association with all types of VHI except for group plans and is therefore to some extent in accordance with the theoretical framework. The probability of illness could be related to old age and health status. People over the age of 65 seek more healthcare than people in their 40s (The National Board of Health and Welfare, 2023). According to theory, health status has a positive effect on demand for VHI due to an increased utility of having better quality healthcare. On the other hand, it also has a negative effect on demand for VHI due to an increased premium. The empirical findings suggest that respondents over the age of 65, have a lower probability of having a VHI and an employer-paid VHI. The results also suggest that respondents with excellent health have a higher probability of having an individual- and employer-paid VHI. A possible explanation of these opposite directions of health-related variables is that the insurance

companies price discriminate on age rather than on health status.

The empirical findings of this study should be interpreted with caution as there are limitations to be aware of. The main limitation is the small sample size. Since the VHI coverage in the population is small, this also results in a sample with low variation of the VHI holding status. For example, in the regions Gotland and Västerbotten, the sample consists of a VHI coverage of zero percent. For the models with different origins, the variation in VHI holding status is even smaller (see Table 9.15 in Appendix B). The consequence of the combination of few observations and low variation of VHI holding status is models with low statistical power. This can lead to a type 2 error, i.e. that there is a relationship but the models are not able to capture it. It is worth noting that the average marginal effects for first visit of 60 and 30 days are significant in the general VHI specification. When testing the association between waiting time to first visit and the probability of having insurance from a certain origin, there are no significant associations. This indicates that there is a lack of statistical power in the models when taking the origin into account. The non-significant results in these models might therefore not be a result of an absence of a relationship between waiting time and the probability of having a VHI from a certain origin. Another limitation of the data is the cross-sectional design. Since the data on VHI holding status only come from 2016, we are not able to estimate any time effects or how demand has changed over time in relation to waiting time. Additionally, a panel structure could have mitigated the limitation of not having information on when an individual changed the VHI holding status as well as allowing us to control for individual, unobservable characteristics. Lastly, the lack of employer characteristics unables us to control for incentives found important in the theoretical framework and in previous studies. According to theory, a company's demand for VHI should increase with the revenue. The models including employer incentives might therefore lack relevant factors of demand and are not capturing its association completely. Relevant drivers of demand are in addition to the revenue and the size of the company. Especially for companies operating in several regions, waiting time at a national level might be more important than waiting time at a regional level.

The data on the VHI coverage used in this study is from 2016 which can impact the external validity of the results. As Tynkkynen et al. (2018) described, waiting time is a

less important factor for the demand for VHI in a more established market and, for example, cultural factors have a more prominent role. Since 2016 the VHI market in Sweden has further expanded and the market can be considered to be more established. This would imply that cultural factors are of even greater importance than it was in 2016. Thus, waiting time could be a less important factor when deciding to obtain a VHI. This study finds no association between waiting time and demand for employer-paid VHI and if waiting time would have a lesser importance today, the results would remain. Thus, we do not see a problem with the generalizability to today's market in this aspect. However, since employer-paid insurance is included in the measurement of VHI, which is shown to have a positive association with waiting time, the results for model 1 might not be generalizable to today's market.

The generalizability of this study could be affected by COVID-19. Due to increased publicity, greater monitoring, and a greater public awareness of the healthcare market, people today might be more aware of waiting times compared to what they were in 2016. This would imply that compared to 2016, an increased effect of waiting time on demand for VHI is expected. Another possible implication of COVID-19 could be that consumers changed the information they base their decision to get insurance. Due to the combination of increased-waiting time and medical attendance in the healthcare sector nationally, as a result of the pandemic (The National Board of Health and Welfare, 2020), consumers could potentially turn a blind eye to the regional waiting time in favor of the national. This would imply that regional waiting time is not directly associated with demand for VHI.

8 Conclusion

In this study, the association between waiting time and the demand for voluntary health insurance in Sweden is investigated. This is done by using a novel combined dataset of VHI data from Riks-SOM 2016 and data on waiting time from SALAR. The analysis is carried out by using probit models to calculate average marginal effects. Non-response bias is mitigated by using post-stratification weights and the waiting time variables are constructed in such a way as to mitigate potential simultaneity bias. An evaluation is made of the association between

waiting time and demand for VHI as well as the demand for the insurances of different origins: individually purchased, employer-paid and group plan. The empirical findings of this study support the first research question and indicate that there is a positive association between waiting time and the demand for VHI. This is in line with the theoretical framework and previous studies. The results indicate that the impact of waiting time on the demand for VHI does not differ depending on the origin of the insurance, which does not support the second research question. This does however not mean that there is no association, or a difference in the associations, as the small sample size with low variability resulted in low statistical power.

As the results of waiting time to first visit in the general VHI model were significant for the 30 and 60 days measurement, and insignificant for the 90 days measurement, it is an indication that the number of days that pass before consumers gain access to specialized healthcare does not impact demand for VHI linearly. If a true relationship is estimated, the fulfillment of the healthcare guarantee of 90 days does not impact the demand for VHI and the consumers instead base their decision on short-term waiting times. The results are however not very robust. The models with the average waiting times between 2010-2013 resulted in significant marginal effects for each waiting time to first visit measurement. By testing the model with different waiting time measurements it is however revealed that waiting time to surgery or other treatment does not have any association with demand for VHI. The differences in which waiting time measurements are found to have an association with the demand for VHI, provide valuable information to policymakers on what makes people opt out of public sector healthcare. Since the results indicate that people do not opt out of the public healthcare sector due to waiting times to surgery, these waiting times could be considered to live up to an acceptable level of quality.

An obstacle in estimating the impact of waiting time on demand for VHI is the potential simultaneity bias. In this study, the approach to account for the potential bias is to exclude the waiting times in the years closer to the survey on VHI coverage. The approach was previously used in the study by Aarbu (2010). A comparison between the results of the main models and the results of the robustness check, where waiting time on years closer to the survey was

included, suggests that the simultaneity bias may have been mitigated using this method. The study lacks data on when the respondent made the decision to obtain a VHI. Therefore it is possible that the disparity in the empirical findings is not caused by simultaneity bias, but rather because the models failed to account for the timing of when the VHI was acquired.

This is the first study that econometrically investigates the association between waiting time and demand for VHI in the Swedish market. In line with previous international research, this study confirms that waiting time has a positive association with demand for VHI also in Sweden. Few studies before this have accounted for the potential impact waiting time has on VHI depending on the origin of the insurance. This study adds to the literature that accounts for the importance of origin and provides more current evidence on this division. The empirical results make it evident that to investigate this relationship further, more and better quality data is required. The study would have benefited from having data with a larger sample and a panel structure in order to be able to draw more causal conclusions. To further investigate the difference in drivers of demand depending on if it is an individual-, employer- or union-provided insurance, more occupational and union characteristics would have been beneficial to control for, in order to get a better image of what drives demand.

9 References

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Appendix A

Detailed description of covariates

Individual characteristics

Age: Previous studies have found age to be an important determinant of demand for healthcare (Bhattacharya, Hyde and Tu, 2014) and it could also have a relationship with having VHI as the premium can have an association with age. For example, consumers over the age of 60 face significantly higher premiums compared to younger consumers (Kullberg, Blomqvist and Winblad, 2019). Instead of including age as a continuous variable, we include several dummy variables of different age groups. These groups are 20s, 30s, 40s, 50-65, and 65+. To decide the age intervals we analyze the frequency of visits to specialized outpatient healthcare for the different age groups, weighted by the population size of the age groups. When examining these groups, with an interval of five-year, we find that older people tend to have more visits to specialized healthcare than younger people (The National Board of Health and Welfare, 2023). However, the relationship does not seem to be linear. Therefore we divide the age groups into 10-year intervals for the ages 20-50. A dummy for the interval of 50-65 years is also included to capture the years before retirement.

The retirement age in Sweden was 65 years at the time of the survey (Swedish Pensions Agency, 2023). Individuals who are retired would not have the possibility to get insurance from an employer or union (unless they got it before retirement), and thus 70-year-olds might have a smaller probability of having a VHI than an individual who is 60 years old.

Gender: Women and men are subject to different health issues and might react differently to the waiting time in different health areas. Demand for health has also been found to differ between the genders (Hunt-Mccool et al. 1995). When it comes to VHI men are overrepresented as insurance holders in Sweden (Palme, 2017). This could be a result of other factors, such as the work sector but a covariate for gender is included to account for potential gender differences.

Household Income: As explained in the theoretical framework, an increase in income is associated with an increase in demand for VHI. Income is also an important determinant of health status and therefore three variables of income are created to control for its potential bias (Bhattacharya, Hyde and Tu, 2014). Three variables of income level are created: Low Household Income (household income below 300,000 SEK), Middle Household Income (household income between 300,000 and 700,000 SEK), and High Household Income (household income above 700,000 SEK).

More than one adult In household: The income level of a one-adult household would not be appropriate to compare with the income level of a two-adult household. Since the income variables are based on the collected household income, a dummy variable that accounts for if there is more than one adult in the household is constructed.

Education: According to the Grossman model of demand for health, a higher level of education leads to increased investments in health (Grossman, 1972). Translated into the context of this study, waiting time might have a larger impact on the demand for VHI of an individual with higher education as their opportunity cost of not getting healthcare quickly is larger. Previous research in Sweden has found a positive correlation between having a VHI and higher education (Palme, 2017; Kullberg, Blomqvist and Winblad, 2019). Three variables of education are created: Lower Education (not graduated from upper secondary school), Upper Secondary School Graduate, and Higher Education (post-upper secondary school studies).

Political affiliation: VHI has caused much political debate in Sweden. The politically left is generally against the market of VHI with the main argument that healthcare should be equal and those in greatest need should have priority. The politically right on the other hand argues that there are inefficiencies in public healthcare and that VHI can help to relieve the public sector (Torkelsson, 2022). We hypothesize that people who are more politically to the left might not want to purchase a VHI for ideological reasons and also that they might be more accepting of longer waiting time than those more politically to the right. Three variables of political affiliation are created: Politically Left, Politically Right, and Politically Center.

Health Status: An important determinant of demand for healthcare is health status. A person who is ill ought to demand more health care than a person who is healthy. Previous evidence from Sweden does however show that people with good health have a VHI to a larger extent than people with poor health (Kullberg, Blomqvist and Winblad, 2019). To control for potential heterogeneity we want to include health status in the models.

One of the control variables for health status is if the respondent has reported excellent health status. This is if the person has responded 8 or higher on the 1-10 scaled question on health status in Riks-SOM 2016. A potential issue with this measurement is the fact that it is self-reported and self-stated health status in previous research found to be dependent on the reference groups (Thiel, 2014). By including other information that can be determinants of health we aim to capture health effects that are not dependent as highly on the reference group. These variables are Exercises Weekly (exercise at least once a week) and Drinks Alcohol Regularly (drinks alcohol several times a week).

Occupational characteristics

Employment Status: It is probable that there are differences in demand depending on the occupational status of the respondent. A person who is retired or unemployed cannot be offered VHI from their employer (unless they had received it when they were previously working). Previous research has shown that blue-collar workers in Sweden tend to hold a VHI to a lower extent than white-collar and self-employed individuals do. When it comes to self-employed individuals, they hold a VHI to a larger extent than those who are white- and blue-collar workers (Kullberg, Blomqvist and Winblad, 2019). A self-employed individual might have a harder time taking time off from work, especially if they do not have employees that can cover some of the work tasks (Aarbu, 2010). To control for these different employment types we create the variables: Unemployed, Self-employed, White Collar, and Blue Collar. Since we already have a control variable for people being 65+, a retirement dummy would create multicollinearity issues in a regression model and is therefore not constructed.

Public Sector: In Sweden, 23% of those working in the private and non-profit sectors have a VHI while only 6% out of those in the public sector have a VHI (Kullberg, Blomqvist and

Winblad, 2019). An employer in the public sector might be less inclined to include VHI as a benefit to their employees. That could result in the magnitude of the waiting time being irrelevant in the decision to offer it to its employees.

Union Member: Insurance can be offered as a group plan to union members in Sweden. A union would not offer this to a non-member therefore we control for this by including a dummy variable that takes the value one if the individual is a union member.

Appendix B

Table 9.1: Chi-Square Test of Independence

Age	Pearson chi-square(16)=20.0000	Pr=0.220
Region	Pearson chi-square(49)=97.2045	Pr=0.000
Gender	Pearson chi-square(1)=2.0000	Pr=0.157

Note: The true population proportion test, against the sub-sample populations.

Table 9.2: Post-Stratification Weights

Sub-Sample Population	VHI	Individual VHI	Employer-paid VHI	Group Plan
Male				
Age: 20-29	2.548	2.584	2.899	2.953
Age: 30-39	1.441	1.636	1.522	1.533
Age: 40-49	0.985	1.091	1.020	1.166
Age: 50-65	0.830	0.856	0.853	0.902
Age: 65+	0.876	0.804	0.833	0.815
Female				
Age: 20-29	2.165	2.121	2.379	2.268
Age: 30-39	1.225	1.343	1.249	1.177
Age: 40-49	0.837	0.895	0.837	0.895
Age: 50-65	0.705	0.702	0.700	0.692
Age: 65+	0.744	0.660	0.683	0.626

Table 9.3: PSW-Test: k*Mean Rule

	VHI	Individual VHI	Employer-paid VHI	Group Plan
Mean	1.235	1.269	1.298	1.303
Largest Weight	2.548	2.584	2.899	2.953
Threshold (k=3)	3.706	3.808	3.893	3.908
Threshold (k=4)	4.942	5.077	5.191	5.210

Table 9.4: PSW-Test: k*Median Rule

	VHI	Individual VHI	Employer-paid VHI	Group Plan
Median	0.930	0.993	0.937	1.034
Largest Weight	2.548	2.584	2.899	2.953
Threshold (k=3)	2.791	2.979	2.811	3.101
Threshold (k=4)	3.721	3.972	3.748	4.135

Table 9.5: PSW-Test: k*Inter-quartile Range + Median Rule

	VHI	Individual VHI	Employer-paid VHI	Group Plan
Median	0.930	0.993	0.937	1.034
IQR	0.556	0.746	0.620	0.609
Largest Weight	2.548	2.584	2.899	2.953
Threshold (k=3)	2.597	3.231	2.796	2.860
Threshold (k=4)	3.153	3.977	3.416	3.468

Table 9.6: Waiting Time to First Visit: 60 days

	(1)	(2)	(3)	(4)
VARIABLES	VHI	Individual VHI	Employer-paid VHI	Group Plan
Waiting Time to First Visit: 60 days	0.027**	0.022	0.029*	0.016
Individual Characteristics				
Age 20s	0.100	0.127	-0.017	0.297
Age 30s	-0.085	-0.493*	-0.301	0.611**
Age 50-65	-0.077	-0.018	-0.155	0.082
Age 65+	-0.639***	-0.166	-1.342***	-0.304
Female	0.032	0.051	-0.039	0.029
Lower Household Income	-0.387**	-0.156	-0.883**	-0.190
Higher Household Income	0.459***	0.448**	0.768***	0.005
More than One Adult in Household	-0.110	-0.073	-0.433**	0.292
Lower Education	-0.003	-0.012	0.056	0.047
Higher Education	0.003	-0.048	0.070	0.149
Politically Left	-0.155	-0.011	0.030	-0.444**
Politically Right	0.089	0.051	0.117	-0.022
Excellent Health	0.167	0.309**	0.268*	-0.221
Exercises Weekly	0.185	0.099	0.023	0.373*
Drinks Alcohol Regularly	-0.276	-0.192	-0.228	-0.460
Occupational Characteristics				
Self-employed	0.625***	0.600***	0.692***	0.276
Blue Collar	-0.337**	-0.262	-0.438**	-0.449**
Unemployed	-0.735**	0.028		
Public Sector	-0.692***	-0.504***	-1.331***	-0.149
Union Member	0.236*	0.057	0.037	0.832***
Constant	-1.593***	-2.245***	-1.614***	-3.090***
Observations	1,106	980	990	940
Pseudo R^2	0.201	0.142	0.326	0.175

Note: Gender- and age population adjusted post-stratification weights are applied. Robust standard errors are used. *** p<0.01, ** p<0.05, * p<0.1.

Table 9.7: Waiting Time to First Visit: 30 days

	(1)	(2)	(3)	(4)
VARIABLES	VHI	Individual VHI	Employer-paid VHI	Group Plan
Waiting Time to First Visit: 60 days	0.019**	0.022*	0.012	0.009
Individual Characteristics				
Age 20s	0.114	0.141	-0.005	0.293
Age 30s	-0.067	-0.469*	-0.290	0.613**
Age 50-65	-0.070	-0.013	-0.145	0.082
Age 65+	-0.631***	-0.164	-1.311***	-0.299
Female	0.045	0.067	-0.016	0.032
Lower Household Income	-0.383**	-0.143	-0.880**	-0.183
Higher Household Income	0.483***	0.486***	0.785***	0.008
More than One Adult in Household	-0.124	-0.071	-0.448**	0.285
Lower Education	0.001	-0.022	0.061	0.046
Higher Education	0.009	-0.054	0.079	0.153
Politically Left	-0.149	0.001	0.037	-0.439**
Politically Right	0.091	0.061	0.129	-0.027
Excellent Health	0.174	0.317**	0.279*	-0.221
Exercises Weekly	0.185	0.099	0.015	0.376*
Drinks Alcohol Regularly	-0.257	-0.155	-0.226	-0.444
Occupational Characteristics				
Self-employed	0.619***	0.599***	0.684***	0.270
Blue Collar	-0.336**	-0.265	-0.431*	-0.446**
Unemployed	-0.744**	0.029		
Public Sector	-0.705***	-0.525***	-1.331***	-0.159
Union Member	0.226*	0.048	0.026	0.824***
Constant	-1.926***	-2.875***	-1.588**	-3.137***
Observations	1,106	980	990	940
Pseudo R^2	0.201	0.147	0.323	0.173

Note: Gender- and age population adjusted post-stratification weights are applied. Robust standard errors are used. *** p<0.01, ** p<0.05, * p<0.1.

Table 9.8: Waiting time to surgery: 90 days

	(1)	(2)	(3)	(4)
VARIABLES	VHI	Individual VHI	Employer-paid VHI	Group Plan
Waiting time to surgery: 90 days	0.004	-0.026	0.018	0.014
Individual Characteristics				
Age 20s	0.088	0.072	-0.023	0.313
Age 30s	-0.090	-0.500*	-0.300	0.607**
Age 50-65	-0.081	-0.043	-0.140	0.080
Age 65+	-0.620***	-0.167	-1.333***	-0.306
Female	0.044	0.043	-0.019	0.039
Lower Household Income	-0.377**	-0.160	-0.857**	-0.199
Higher Household Income	0.457***	0.439**	0.769***	-0.006
More than One Adult in Household	-0.113	-0.079	-0.443**	0.289
Lower Education	0.011	0.019	0.057	0.053
Higher Education	0.002	-0.060	0.067	0.155
Politically Left	-0.154	-0.018	0.026	-0.437**
Politically Right	0.089	0.049	0.115	-0.024
Excellent Health	0.168	0.330**	0.264*	-0.230
Exercises Weekly	0.176	0.084	0.014	0.382*
Drinks Alcohol Regularly	-0.265	-0.172	-0.229	-0.450
Occupational Characteristics				
Self-employed	0.604***	0.598***	0.686***	0.267
Blue Collar	-0.334**	-0.245	-0.439**	-0.462**
Unemployed	-0.725*	0.079		
Public Sector	-0.685***	-0.477***	-1.322***	-0.152
Union Member	0.242*	0.062	0.038	0.839***
Constant	-1.058***	-1.126**	-1.393**	-3.066***
Observations	1,106	980	990	940
Pseudo R^2	0.195	0.143	0.323	0.174

Note: Gender- and age population adjusted post-stratification weights are applied. Robust standard errors are used. *** p<0.01, ** p<0.05, * p<0.1.

Table 9.9: Waiting time to surgery: 60 days

	(1)	(2)	(3)	(4)
VARIABLES	VHI	Individual VHI	Employer-paid VHI	Group Plan
Waiting time to surgery: 60 days	0.003	-0.018	0.014	0.011
Individual Characteristics				
Age 20s	0.088	0.075	-0.027	0.311
Age 30s	-0.090	-0.500*	-0.300	0.606**
Age 50-65	-0.081	-0.042	-0.140	0.079
Age 65+	-0.621***	-0.167	-1.335***	-0.308
Female	0.044	0.044	-0.018	0.039
Lower Household Income	-0.376**	-0.161	-0.856**	-0.199
Higher Household Income	0.457***	0.439**	0.768***	-0.006
More than One Adult in Household	-0.114	-0.078	-0.444**	0.288
Lower Education	0.011	0.018	0.058	0.055
Higher Education	0.002	-0.060	0.066	0.155
Politically Left	-0.153	-0.019	0.027	-0.437**
Politically Right	0.090	0.048	0.116	-0.023
Excellent Health	0.168	0.329**	0.264*	-0.230
Exercises Weekly	0.176	0.084	0.015	0.382*
Drinks Alcohol Regularly	-0.266	-0.173	-0.229	-0.450
Occupational Characteristics				
Self-employed	0.604***	0.596***	0.686***	0.267
Blue Collar	-0.334**	-0.246	-0.440**	-0.462**
Unemployed	-0.725*	0.078		
Public Sector	-0.685***	-0.478***	-1.325***	-0.151
Union Member	0.242*	0.060	0.039	0.840***
Constant	-1.072**	-1.123**	-1.440**	-3.095***
Observations	1,106	980	990	940
Pseudo R^2	0.195	0.142	0.323	0.174

Note: Gender- and age population adjusted post-stratification weights are applied. Robust standard errors are used. *** p<0.01, ** p<0.05, * p<0.1.

Table 9.10: Waiting time to surgery: 30 days

	(1)	(2)	(3)	(4)
VARIABLES	VHI	Individual VHI	Employer-paid VHI	Group Plan
Waiting time to surgery: 30 days	0.001	-0.022	0.016	0.012
Individual Characteristics				
Age 20s	0.086	0.073	-0.028	0.312
Age 30s	-0.090	-0.498*	-0.301	0.604**
Age 50-65	-0.082	-0.043	-0.141	0.080
Age 65+	-0.619***	-0.167	-1.333***	-0.308
Female	0.044	0.044	-0.017	0.040
Lower Household Income	-0.377**	-0.163	-0.858**	-0.202
Higher Household Income	0.457***	0.442**	0.765***	-0.007
More than One Adult in Household	-0.114	-0.077	-0.445**	0.288
Lower Education	0.012	0.014	0.059	0.058
Higher Education	0.003	-0.063	0.066	0.157
Politically Left	-0.154	-0.017	0.026	-0.438**
Politically Right	0.090	0.047	0.117	-0.023
Excellent Health	0.169	0.333**	0.263*	-0.231
Exercises Weekly	0.175	0.085	0.015	0.383*
Drinks Alcohol Regularly	-0.265	-0.168	-0.231	-0.451
Occupational Characteristics				
Self-employed	0.603***	0.599***	0.684***	0.265
Blue Collar	-0.332**	-0.244	-0.440**	-0.462**
Unemployed	-0.723*	0.085		
Public Sector	-0.685***	-0.479***	-1.325***	-0.151
Union Member	0.242*	0.056	0.041	0.841***
Constant	-1.055	-0.522	-1.822*	-3.388***
Observations	1,106	980	990	940
Pseudo R^2	0.195	0.143	0.323	0.174

Note: Gender- and age population adjusted post-stratification weights are applied. Robust standard errors are used. *** p<0.01, ** p<0.05, * p<0.1.

Table 9.11: Average Marginal Effects: 2011-2013

	(1)	(2)	(3)	(4)
VARIABLES	VHI	Individual VHI	Employer-paid VHI	Group Plan
Waiting time to first visit				
90 days	0.007**	0.001	0.005	0.002
	(0.003)	(0.002)	(0.003)	(0.002)
60 days	0.005**	0.001	0.002	0.001
	(0.002)	(0.001)	(0.002)	(0.001)
30 days	0.003*	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Waiting time to surgery				
90 days	0.001	-0.002	0.002	0.001
	(0.002)	(0.001)	(0.002)	(0.001)
60 days	0.001	-0.001	0.002	0.001
	(0.002)	(0.001)	(0.002)	(0.001)
30 days	0.001	-0.001	0.003	0.001
	(0.002)	(0.001)	(0.002)	(0.001)
Individual characteristics included	Yes	Yes	Yes	Yes
Occupational characteristics included	Yes	Yes	Yes	Yes
Observations	1,106	980	990	940

Note: Gender- and age population adjusted post-stratification weights are applied. Individual characteristics include: Age 20s, Age 30s, Age 50-65, Age65+, Female, Lower Household Income, Higher Household Income, More than One Adult in Household, Lower Education, Higher Education, Politically Left, Politically Right, Excellent Health, Exercises Weekly and Drinks Alcohol Regularly. Occupational characteristics include: Self-employed, Blue Collar, Unemployed, Public Sector and Union Member. The covariate Unemployed is omitted in model 3 & 4. Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 9.12: Average Marginal Effects: 2010-2016

	(1)	(2)	(3)	(4)
VARIABLES	VHI	Individual VHI	Employer-Paid VHI	Group Plan
Waiting time to first visit				
90 days	-0.002	-0.003	0.003	0.001
	(0.003)	(0.002)	(0.002)	(0.002)
60 days	-0.000	-0.001	0.002	0.001
	(0.002)	(0.001)	(0.001)	(0.001)
30 days	0.001	0.000	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Waiting time to surgery				
90 days	0.002	0.000	0.001	0.001
	(0.002)	(0.001)	(0.001)	(0.001)
60 days	0.003*	0.001	0.002	0.001
	(0.002)	(0.001)	(0.001)	(0.001)
30 days	0.004*	0.001	0.003	0.001
	(0.002)	(0.001)	(0.002)	(0.001)
Individual characteristics included	Yes	Yes	Yes	Yes
Occupational characteristics included	Yes	Yes	Yes	Yes
Observations	1,106	980	990	940

Note: Gender- and age population adjusted post-stratification weights are applied. Individual characteristics include: Age 20s, Age 30s, Age 50-65, Age65+, Female, Lower Household Income, Higher Household Income, More than One Adult in Household, Lower Education, Higher Education, Politically Left, Politically Right, Excellent Health, Exercises Weekly and Drinks Alcohol Regularly. Occupational characteristics include: Self-employed, Blue Collar, Unemployed, Public Sector and Union Member. The covariate Unemployed is omitted in model 3 & 4. Standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 9.13: Linear-Probability Models

	(1)	(2)	(3)	(4)
VARIABLES	VHI	Individual VHI	Employer-Paid VHI	Group Plan
Waiting time to first visit				
90 days	0.004	0.001	0.004*	0.000
	(0.003)	(0.002)	(0.003)	(0.002)
60 days	0.005*	0.001	0.002	0.001
	(0.002)	(0.001)	(0.002)	(0.002)
30 days	0.003*	0.002	0.001	0.001
	(0.002)	(0.001)	(0.002)	(0.001)
Waiting time to surgery				
90 days	0.000	-0.002	0.002	0.001
	(0.003)	(0.001)	(0.002)	(0.002)
60 days	0.000	-0.001	0.001	0.001
	(0.002)	(0.001)	(0.002)	(0.001)
30 days	-0.000	-0.002	0.001	0.001
	(0.002)	(0.001)	(0.002)	(0.001)
Individual characteristics included	Yes	Yes	Yes	Yes
Occupational characteristics included	Yes	Yes	Yes	Yes
Observations	1,106	980	990	940

Note: Coefficients of the different waiting time measurements for the 24 linear probability models are reported. Gender- and age population adjusted post-stratification weights are applied. Individual characteristics include: Age 20s, Age 30s, Age 50-65, Age65+, Female, Lower Household Income, Higher Household Income, More than One Adult in Household, Lower Education, Higher Education, Politically Left, Politically Right, Excellent Health, Exercises Weekly and Drinks Alcohol Regularly. Occupational characteristics include: Self-employed, Blue Collar, Unemployed, Public Sector and Union Member. The covariate Unemployed is omitted in model 3 & 4. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 9.14: Average Marginal Effects: Without Post-Stratification Weights

	(1)	(2)	(3)	(4)
VARIABLES	VHI	Individual VHI	Employer-Paid VHI	Group Plan
Waiting time to first visit				
90 days	0.004	0.001	0.003	0.002
	(0.003)	(0.002)	(0.002)	(0.002)
60 days	0.005**	0.001	0.003	0.001
	(0.002)	(0.001)	(0.002)	(0.001)
30 days	0.003*	0.002*	0.001	0.000
	(0.002)	(0.001)	(0.001)	(0.001)
Waiting time to surgery				
90 days	0.001	-0.002	0.002	0.002
	(0.002)	(0.002)	(0.002)	(0.001)
60 days	0.001	-0.001	0.001	0.001
	(0.002)	(0.001)	(0.001)	(0.001)
30 days	0.001	-0.002	0.001	0.002
	(0.002)	(0.001)	(0.002)	(0.001)
Individual characteristics included	Yes	Yes	Yes	Yes
Occupational characteristics included	Yes	Yes	Yes	Yes
Observations	1,106	980	990	940

Note: Gender- and age population adjusted post-stratification weights are applied. Individual characteristics include: Age 20s, Age 30s, Age 50-65, Age65+, Female, Lower Household Income, Higher Household Income, More than One Adult in Household, Lower Education, Higher Education, Politically Left, Politically Right, Excellent Health, Exercises Weekly and Drinks Alcohol Regularly. Occupational characteristics include: Self-employed, Blue Collar, Unemployed, Public Sector and Union Member. The covariate Unemployed is omitted in model 3 & 4. Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 9.15: Percentage of sample with VHI per Region

Region	VHI	Individual VHI	Employer-paid VHI	Group Plan
Stockholm	18.78	4.69	10.80	3.29
Uppsala	17.14	0.00	14.29	2.86
Södermanland	17.14	2.86	5.71	8.57
Östergötland	10.42	2.08	4.17	4.17
Jönköping	10.53	0.00	2.63	7.89
Kronoberg	25.00	0.00	18.75	6.25
Kalmar	7.14	0.00	3.57	3.57
Gotland	0.00	0.00	0.00	0.00
Blekinge	15.38	15.38	0.00	0.00
Skåne	18.67	5.42	10.24	3.01
Halland	2.56	0.00	2.56	0.00
Västra Götaland	14.44	4.81	8.02	1.60
Värmland	27.59	10.34	10.34	6.90
Örebro	10.53	0.00	2.63	5.26
Västmanland	25.00	9.38	12.50	3.13
Dalarna	18.52	3.70	11.11	3.70
Gävleborg	23.33	13.33	6.67	3.33
Västernorrland	10.00	6.67	3.33	0.00
Jämtland	4.17	4.17	0.00	0.00
Västerbotten	0.00	0.00	0.00	0.00
Norrbotten	13.51	0.00	5.41	8.11
Total	**13.80**	**3.94**	**6.32**	**3.41**

Table 9.16: Waiting time per Region (2010-2013)

	Visit			Surgery		
Region	**90 days**	**60 days**	**30 days**	**90 days**	**60 days**	**30 days**
Stockholm	13.96	21.91	41.14	21.71	30.95	52.95
Uppsala	16.14	31.02	57.65	25.44	35.54	57.34
Södermanland	14.96	30.85	58.65	33.55	48.00	68.10
Östergötland	7.96	17.93	41.89	22.77	32.00	53.71
Jönköping	5.81	15.71	42.28	25.93	35.78	57.99
Kronoberg	6.31	17.21	44.53	26.83	36.71	58.60
Kalmar	7.97	16.38	40.74	21.13	30.05	51.98
Gotland	5.63	16.36	44.07	16.97	24.95	46.63
Blekinge	8.04	20.03	48.26	20.36	28.80	50.33
Skåne	13.78	25.14	51.66	28.66	40.06	61.37
Halland	4.90	17.21	50.01	19.86	28.33	50.13
Västra Götaland	7.08	18.76	48.07	20.80	29.42	51.09
Värmland	10.53	25.02	53.65	21.00	29.67	51.16
Örebro	13.77	31.32	61.87	24.72	34.18	54.74
Västmanland	9.35	24.92	57.34	22.60	32.28	53.95
Dalarna	18.39	32.86	56.99	35.88	48.24	65.49
Gävleborg	10.65	22.83	50.04	18.23	26.42	47.94
Västernorrland	11.29	25.08	54.00	19.07	27.35	48.86
Jämtland	16.08	31.59	60.29	23.79	33.22	54.33
Västerbotten	11.47	25.44	52.06	31.52	44.45	65.33
Norrbotten	9.65	20.89	47.56	17.77	25.89	47.28

Note: Share of patients that did not get a visit/surgery to the outpatient specialized healthcare within 90, 60 and 30 days.