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Chapter 3

Advantageous Selection in a Dynamic Framework

3.1 Introduction

The textbook example of selection in the market for health insurance describes individuals that only differ in health status, and therewith expected health care costs. The higher expected health care cost of unhealthy individuals implies that they will benefit more from having insurance. This results in unhealthy individuals being more likely to buy insurance than healthy individuals: the typical case of adverse selection. Recent empirical evidence on selection in health insurance markets, however, shows *advantageous* selection instead of *adverse* selection. This result was found, *inter alia*, by Finkelstein and McGarry (2006), Fang, Keane and Silverman (2008), Cutler, Finkelstein and McGarry (2008) and Bolhaar, Lindeboom and Van der Klaauw (2008).

Advantageous selection is a counterintuitive concept: why would healthy people with low expected medical costs, the so-called 'good risks', insure themselves for health care expenses while the less healthy refrain from doing so? De Meza and Webb (2001) argue that the key to advantageous selection lies in the willingness to buy insurance and undertaking precautionary effort being positively correlated. This positive correlation may arise if risk preferences are heterogeneous among agents. More risk averse agents are more likely to buy insurance and will also be more inclined to undertake precautionary effort, resulting in a better health. Alternatively, heterogeneity in 'optimism' can be another situation in which insurance purchase and precautionary effort are correlated according to De Meza and Webb (2001). Optimistic agents will not feel the need to buy insurance, and their '*it won't happen to me*' attitude towards risk will not encourage precautionary behaviour, resulting in a lower level of health.

In the empirical literature on advantageous selection, Finkelstein and McGarry (2006) look at the market for insurance covering the costs of long-term care (in particular nursing homes) in the US. They find that wealthier individuals and individuals that are more

cautious are both more likely to buy insurance and less likely to use long-term care. Fang, Keane and Silverman (2008) find that individuals purchasing Medigap insurance (which covers care not covered by Medicare) tend to be healthier than agents that don't do so. Information on risk preferences is used to investigate the hypothesis that advantageous selection is driven by heterogeneity in risk preferences. Interestingly, they do not find evidence to support this hypothesis: more risk averse individuals buy more insurance, but are not healthier. The information on risk preferences, however, comes from questions about financial risk taking behaviour. Risk preferences concerning financial risks might differ from risk preferences concerning health risks. Furthermore, where financial risk preferences might be correlated with wealth, health risk preferences are less likely to do so. It is therefore not so clear whether the heterogeneity in risk preferences is not causing advantageous selection here, or whether risk preferences are not well observed. Cutler, Finkelstein and McGarry (2008) use more health related measures of risk aversion to look at different insurance markets. Individuals engaging in risky behaviours (smoking, having 3 or more alcoholic drinks per day, job-related mortality risk) and not undertaking precautionary effort (use of preventative health care, use of seat belts) are found to be less likely to buy any of the five insurance types considered in the paper (term life insurance, acute health insurance, an annuity, Medigap insurance and long term care insurance). At the same time, the expected claims of these individuals are high for term life insurance and long term care insurance, pointing to advantageous selection that runs via heterogeneity in risk aversion. For Medigap and acute health insurance the more risky behaving individuals do not have a higher level of expected costs and the advantageous selection most likely runs via another pathway than heterogeneity in risk aversion.

The source(s) of advantageous selection might differ between markets, due to differences in institutions, market characteristics, etc. Heterogeneity in either risk aversion or preferences therefore might play a role in some insurance markets and not in other. There might also be pathways different from the ones mentioned by De Meza and Webb via which advantageous selection runs. Fang, Keane and Silverman (2008) mention in this respect cognitive ability as another source.

In the existing literature, theoretical models are of a static nature (De Meza and Webb, 2001; Bajari, Hong and Khwaja, 2006, and Fang, Keane and Silverman, 2008). This chapter will investigate how advantageous selection can arise if the theoretical model is extended to a dynamic framework. It will be shown that the dynamic model requires less strong assumptions to generate advantageous selection as its static counterpart. In a framework that allows for investing in health, preferences and risk aversion do not only have a direct effect on the choices an individual makes. This period's choices also affect next periods' health, which in turn will influence next periods' choices. I will show in this chapter that due to this kind of *dynamic effects*, the correlation between health and preferences (or risk aversion) arises *naturally*. This is in contrast with the static model that needed to *assume* this correlation to generate advantageous selection. It also turns out

not to be necessary to assume that individuals in good health have a smaller probability of being hit by a health shock than individuals in bad health. Even if the probability of a health shock is the same for all individuals, irrespective of their health, the correlation between health and preferences (or risk aversion) arises automatically. And with this correlation also advantageous selection.

The dynamic framework offers the possibility, in contrast with a static framework, to also include wealth in the theoretical model and therewith the opportunity for individuals to use accrued savings as an alternative to insurance. This will complicate the model, but also makes it much more realistic.

The aim of this chapter is not to derive general results, but to show how advantageous selection can arise in a dynamic framework and how much heterogeneity is needed to get to this result. Heterogeneity in just one structural parameter, the relative preference of consumption over health, will shown to be sufficient to change the selection pattern from adverse to advantageous. However, with only heterogeneity in the risk aversion parameter, this result is more difficult to obtain and requires unrealistic values of this parameter. In addition, this chapter provides a formalization of De Meza and Webb's arguments.

The remainder is organized as follows: section 3.2 sets up the framework for the analysis by defining a model in which individuals can insure themselves against the (health care) costs that come with health shocks by purchasing health insurance. Subsequently, this section discusses the numerical procedure by which the model is solved. Section 3.3 describes a number of experiments in which the model is simulated using different specifications and analyzes the selection pattern that occurs in each of these experiments. Section 3.4 concludes.

3.2 Model

3.2.1 Setup

Consider an individual with a stock of health H_t and a stock of wealth W_t . In each period the individual tries to optimize the present value of future utility. The individual derives utility in every period from current consumption C_t (which includes all types of consumption except health care consumption), and from the current stock of health H_t . The per period utility function is specified to be Cobb-Douglas, with α representing the relative preference for consumption as compared to health, as

$$U(C_t, H_t) = (u(C_t))^\alpha H_t^{1-\alpha} \quad (3.1)$$

We follow the existing literature (Brown and Finkelstein, 2006; Bajari, Hong and Khwaja, 2006; Fang, Keane and Silverman, 2008) and assume a CRRA function for the

utility of consumption $u(C_t)$, with risk aversion parameter γ :

$$u(C_t) = \frac{C_t^{1-\gamma}}{1-\gamma}$$

Risk averse individuals (with $\gamma > 0$) have a strong preference to avoid large fluctuations in consumption. In this model, fluctuations in consumption can be caused by the occurrence of a health shock. An individual faces the risk of being hit by an (adverse) health shock in every period t . Let Δ_t denote an indicator which equals one in case of a shock. The probability with which shocks occur is exogenous.

Individuals can improve their health by making health investments Z_t . Investing in health can be done in reaction to the deterioration of health over time or a health shock, but also with a preventive goal. This follows Bajari, Hong and Khwaja (2006) and Cardon and Hendel (2001), who also allow for medical expenditures for preventive purposes. For ease of exposition it is assumed that Z_t is unidimensional, but Z_t can also be a vector with different types of health investments. It is assumed that in reaction to a health shock Δ_t some health investments have to be made immediately. The size of these acute investments is ϕ . The acute investments do not fully restore the individual's health to the level before the shock. The difference between health before the shock and health after the shock and the acute investment is of size β_3 . Restoring health completely to its level before the shock by making enough health investments to undo β_3 is optional. The individual can choose to (partly) restore it now, in the future, or not at all.

The health stock H_t in each period is thus a function of previous period's health stock, the health shock indicator Δ_t and health investments Z_t . The specification used here for the health 'production function' is additive in all its determinants,

$$H_t = \beta_0 + \beta_1 H_{t-1} + \beta_2 Z_t - \beta_3 \Delta_t \quad (3.2)$$

Individuals have the possibility to insure themselves against the costs of medical care. Health insurance I_t reduces the out-of-pocket cost of health investments with a fraction κ and is charged a per period premium q . Total medical expenses M_t are now defined as the sum of health care costs and (if applicable) the insurance premium

$$M_t = (1 - \kappa I_t)(\phi \Delta_t + Z_t) + q I_t$$

The individual has to decide on buying health insurance before it is revealed to him whether he is hit by a health shock that period. The way health shocks are modelled, with acute investments that have to be made the same period of size ϕ , ensures that there is a value to holding health insurance when there is insecurity about being hit by a shock. Would the complete health shock be modelled as optional to restore, it would be optimal for individuals to wait with making any investments in health until health insurance is bought and the same investments can be made at lower cost. In that case

health insurance would be like a discount card you can buy when you know you will make large investments. Insurance, however, implies that there is uncertainty about whether you will incur the costs you are insured for. Modelling a part of the shock as compulsory to restore in period t also matches reality much closer, as for most health shocks a treatment is hard to postpone.

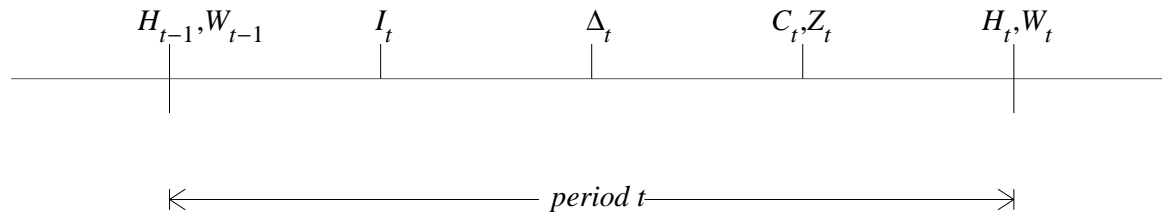
Individuals are constrained in their budget by their income Y_t , which is assumed to be constant over time ($Y = Y_t$), and accumulated wealth. Like Bajari, Hong and Khwaja (2006), Brown and Finkelstein (2006) and Fang, Keane and Silverman (2006) we assume that income is exogenous and predetermined, it does for example not depend on the individual's health status. Wealth can be accumulated (saved) and used (dissaved), but there can never be a negative stock of wealth, so $W_t \geq 0$. The budget constraint can be written as

$$W_t = Y + (1 + \delta) W_{t-1} - C_t - M_t \quad (3.3)$$

The possibility to accumulate a stock of wealth that can be used (dissaved) when needed creates an alternative for insurance as a way to smooth consumption.

To summarize, the timing of events is thus as follows:

Figure 3.1: Timing of events



Individuals enter period t with a health and wealth stock, H_{t-1} and W_{t-1} , and first have to decide on whether to insure themselves. Only after the insurance decision is made it is revealed to them whether they are hit by a health shock. Given insurance status I_t and the revealed health shock Δ_t , they subsequently decide how much to spend on the consumption good C_t , on health investments Z_t and how much is left to save S_t . This in turn results in a new health stock H_t and a new wealth stock W_t , with which period t ends and period $t + 1$ starts.

The dynamic setting implies that individuals will take into account the effect the choices they make today, will have on their future utility as they maximize total *lifetime* utility. Let ρ denote the individual's (subjective) valuation of future utility. Each period's value function can now be written as

$$V_t(H_{t-1}, W_{t-1}) = \max_{I_t} E_{\Delta_t} \left[\max_{C_t, Z_t} U(C_t, H_t) + \rho V_{t+1}(H_t, W_t) \right] \quad (3.4)$$

The individual decides to take health insurance in period t if, given his health H_{t-1} and wealth W_{t-1} , the present value of future utility (the value function) for $I_t = 1$ exceeds the present value of future utility for $I_t = 0$.

3.2.2 Solution method

For a given choice of parameters, we use numerical techniques to solve the model and investigate its behavior. Assume an individual makes decisions based on an infinite horizon. The individual's health and wealth will converge to a stationarity state.

In the stationary state it must hold that for every possible combination of H_{t-1} and W_{t-1} , we have a function $V(\cdot)$ for which holds that

$$V(H_{t-1}, W_{t-1}) = \max_{I_t} \Delta_t \left[\max_{C_t, Z_t} U + \rho V(H_t, W_t) \right] \quad \forall t \quad (3.5)$$

As proven by Stokey and Lucas (1989), there is a unique value function $V(\cdot)$ that solves equation (3.5). Furthermore, this unique value function can be found by value function iteration using any initial vector for $V(\cdot)$.

The iterative process works as follows:

1. Create a grid of combinations of $H = 0, \dots, H$ and $W = 0, \dots, W$.
2. Set the initial value function V^0 at each point of this grid to 0, $V^0(H_t, W_t) = 0$.
3. For each point (H_{t-1}, W_{t-1}) on the HW -grid:
 - (a) For each combination of $I_t = 0, 1$ and $\Delta_t = 0, 1$, find the levels of Z_t and C_t that maximize $V(H_{t-1}, W_{t-1} | I_t, \Delta_t) = U(C_t, H_t) + \rho V^0(H_t, W_t)$, taking into account that $Z_t \geq 0$, $C_t \geq 0$, $Z_t \leq \frac{Y - qI_t}{1 - \kappa I_t} - \phi \Delta_t$ and $C_t \leq Y + (1 + \delta)W_{t-1}$. Use interpolation on the HW -grid to find the value of $V^0(H_t, W_t)$
 - (b) Select the insurance status that maximizes the expected value of the value function, $\max_{I_t=0,1} (kV(H_{t-1}, W_{t-1} | I_t, \Delta_t = 1) + (1 - k)V(H_{t-1}, W_{t-1} | I_t, \Delta_t = 0))$
 - (c) The updated value function, V^1 , at this combination of H_{t-1} and W_{t-1} equals the expected value of the value function under the optimal insurance status.
4. If the distance d between the updated and the original value function (V^1 and V^0) is smaller than 0.0001 for each point (H_{t-1}, W_{t-1}) on the HW -grid, the process ends. Else, step 3 is repeated with value function V^1 to obtain a new updated value function, V^2 etc.

The obtained valuefunction $V(H, W)$ can be used to generate profiles of the long-run levels of health and wealth and profiles on consumption and health investments at different levels of health and wealth.

3.3 Simulation experiments

The model will be used for some simulation experiments. After having defined a baseline experiment, the experiments assess the impact of different types of heterogeneity in structural parameters. In all experiments the main interest is the type of selection that occurs. Therefore, I focus on the correlation between the health status at the start of the period H_{t-1} and the insurance decision in that period I_t . By using the health status *before* the health insurance decision is taken, contamination of selection effects by moral hazard is prevented. Finding a negative correlation coefficient is a sign of adverse selection, a positive correlation points to advantageous selection.

3.3.1 Model without wealth

To start with, a model is assessed in which it is not possible to save or borrow and hence $W_t = 0$ for all t . The model is solved using the set of parameter values depicted in Table 3.1. The relative preference of consumption over health is set at 0.85, equal to 1 minus the fraction of GDP that the US spends on health care. Individuals are assumed to be not very risk averse, with a risk aversion parameter of 0.05. As health deteriorates only slowly over time during most of the lifetime, state dependence in health is taken to be high, at 0.9. A health shock requires a direct investment of 40% of the income in health. The subjective discount rate is 0.95. Health shocks occur with probability 0.1, resulting in an expected per period acute health investment of 4. The cost reduction health insurance offers is set at 50%, as most insurance contracts include some disincentive for unlimited health care use, like a deductible or a copayment rate. Health insurance therefore reduces the expected per period acute investment to 2. Insurance companies will only offer insurance at a premium above this expected per period forced investment. The insurance premium is therefore set at 6.

Table 3.1: Parameter values for baseline simulation

relative preference for consumption over health	α	0.85
risk aversion	γ	0.05
intercept health production function	β_0	0
state dependence in health	β_1	0.9
return to medical consumption	β_2	1.1
health loss from shock	β_3	15
acute investment if health shock	ϕ	40
subjective discount rate	ρ	0.95
probability of health shock		0.1
income	Y	100
insurance premium	P	6
cost reduction offered by health insurance	κ	0.5
interest rate	δ	0.01

The optimal levels of the choice variables at these parameters are shown in Figure 3.2. The upper left panel of this figure shows the values of function V and the upper right panel the optimal insurance decision in the steady state at different health levels. If health is below 20, it's optimal for the individual to buy insurance. If health is at or above this level, not buying insurance is the optimal decision. The optimal level of consumption and health investments in the steady state depends on the occurrence of a shock in the particular period. The lower four panels in Figure 3.2 give the optimal consumption and health investment levels for both cases. The panels on the left reflect the case with no health shock, and show a lower level of health investments and a higher level of consumption than the panels on the right, that reflect the case of a health shock.

The steady state level of health does not depend on the initial health level. Starting from different initial health levels, there is convergence to the same steady state level of health. To illustrate this, the model is simulated for 100 periods with four different initial levels of health. For each of the four different initial health levels, 250 simulations are performed. These 250 simulations only differ in the sequence of draws from the distribution of health shocks. The results of these simulations are shown in Figure 3.3. Within 6 periods health converges to its steady state level, even if the initial level of health is four times the steady state level or a quarter of the steady state level. The long-term level of health is not just one health level. Due to the health shocks the long term health level fluctuates between 10.5 and 34.5. The average of the mean health level in periods 30 to 100 is 22.29, 22.25, 22.24 and 22.21 for respectively $H_0 = 5$, $H_0 = 20$, $H_0 = 40$ and $H_0 = 80$.

Changing one of the parameters has an effect on what the optimal choices of the individual are. Figure 3.4 shows how the optimal insurance decision is rendered when α is changed. The baseline level of α , 0.85, is changed to 0.6. For individuals with a higher α (i.e. a stronger preference for consumption over health), buying health insurance is the optimal choice only for lower levels of health compared to those with a lower α . If the higher value of α also leads to a lower steady state level of health, advantageous selection may occur as lower health levels coincide with a lower probability of buying insurance ($\alpha = 0.85$) and higher health levels coincide with a higher probability of buying insurance ($\alpha = 0.6$). Figure 3.5 shows how the steady state level of health changes when α decreases from 0.85 to 0.6. Indeed, the higher value of the preference parameter leads to a lower steady state level of health.

To further investigate whether there is advantageous selection, the model is simulated for 100 periods. 250 simulations are performed, that only differ in the sequence of draws from the distribution of health shocks. For every period the correlation between the health status at the start of the period H_{t-1} and the insurance decision in that period I_t is calculated. As health fluctuates around a steady state level, there is slight variation over the periods in the correlation between health and the insurance decision.

Figure 3.2: Optimal choices in model without wealth

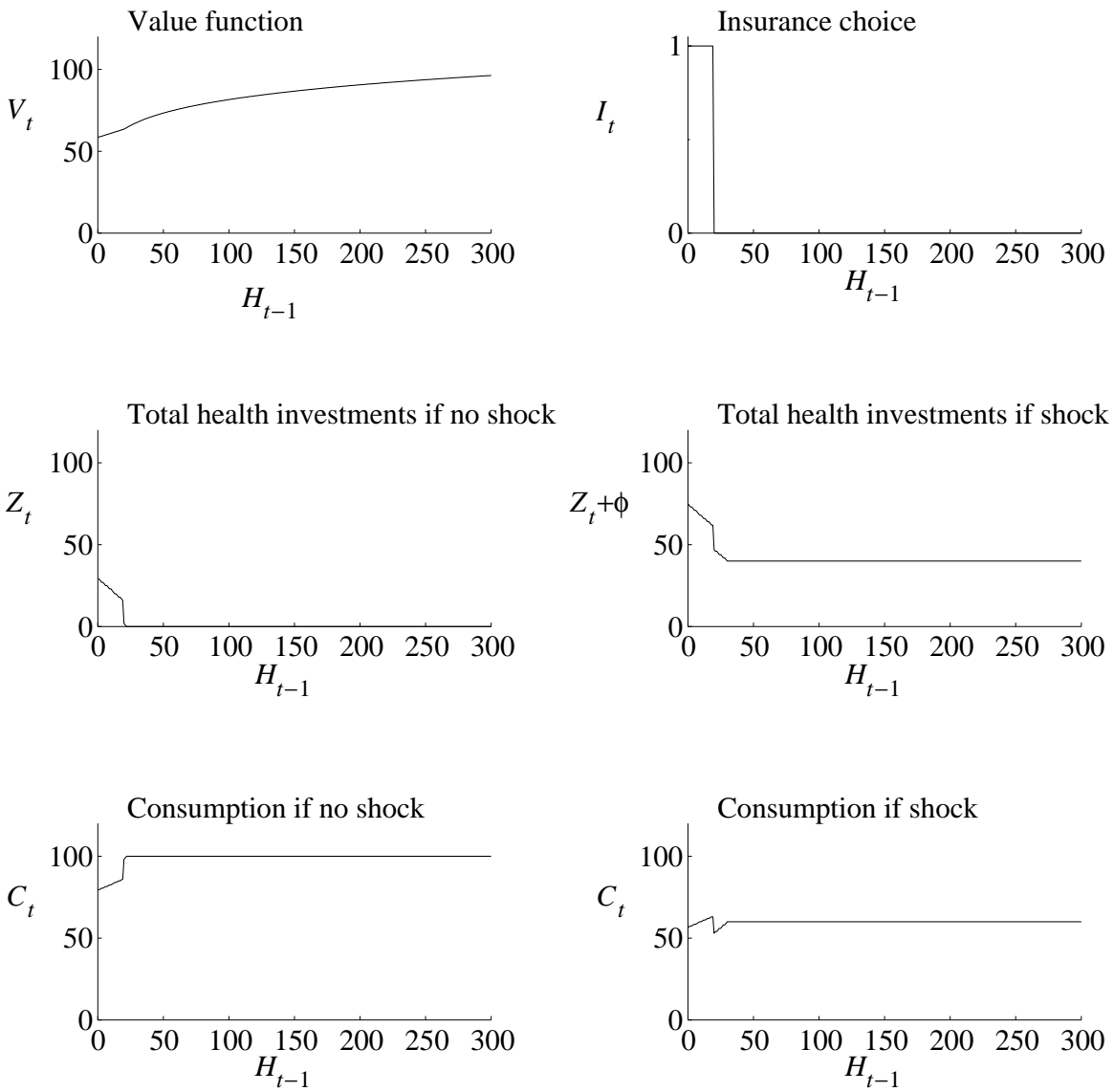


Figure 3.3: Steady state level of health, starting from different initial health levels

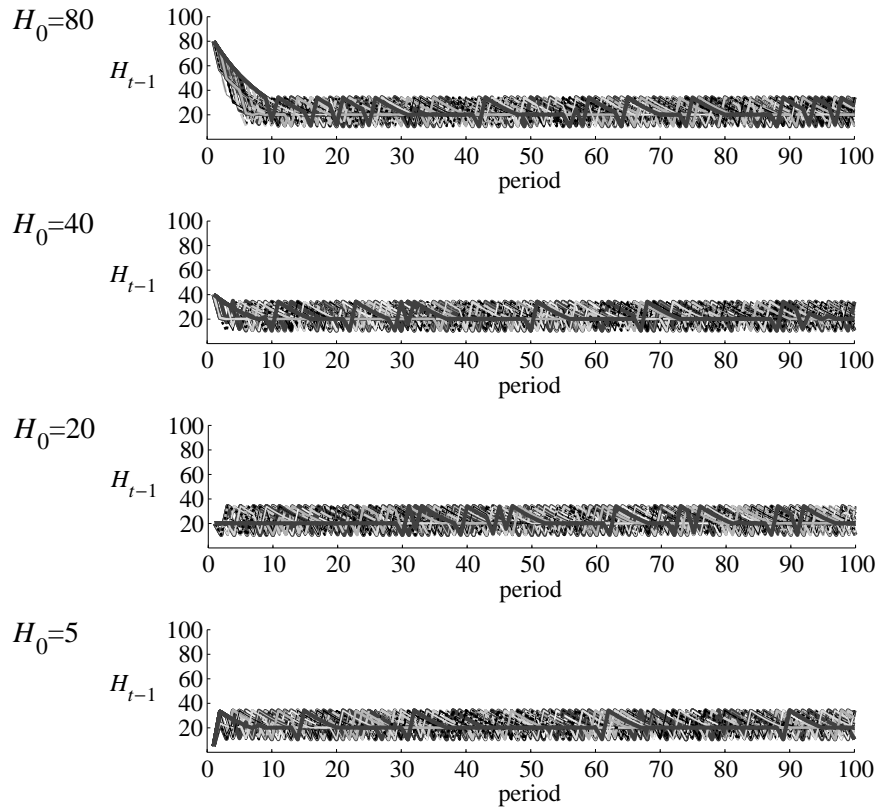
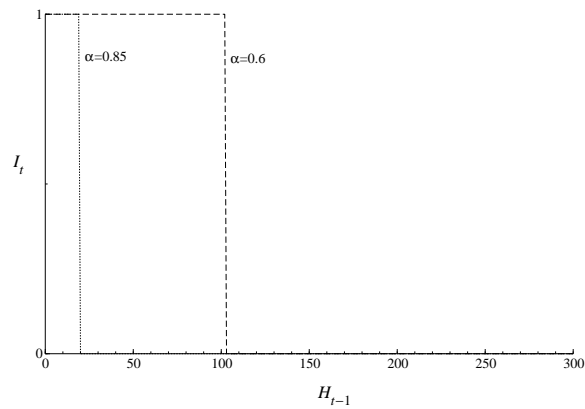
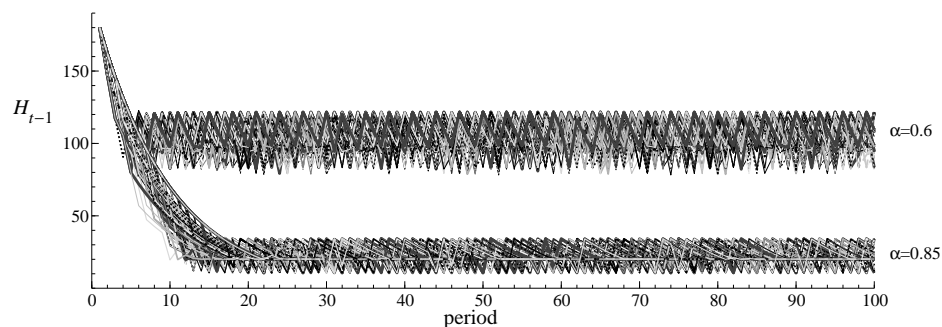
Figure 3.4: Optimal insurance decision for different values of α 

Figure 3.5: Steady state health level at different values of α Table 3.2: (Average) correlation coefficients of health and insurance choice for a sample with 50% individuals with the baseline value for α and γ and 50% individuals with $\alpha = \alpha'$ and $\gamma = \gamma'$, model without wealth

	$\alpha' = 0.85$	$\alpha' = 0.80$	$\alpha' = 0.75$	$\alpha' = 0.70$	$\alpha' = 0.65$	$\alpha' = 0.60$
$\gamma' = 0.05$	-0.596***	-0.321***	-0.126	0.0001	0.093	0.171**
$\gamma' = 0.10$	-0.577***	-0.247***	-0.104	0.017	0.151*	0.178***
$\gamma' = 0.15$	-0.501***	-0.221***	-0.035	0.036	0.175**	0.190***
$\gamma' = 0.20$	-0.451***	-0.182***	-0.018	0.055	0.169***	0.200***
$\gamma' = 0.25$	-0.392***	-0.151**	-0.000	0.125	0.174**	0.277***
$\gamma' = 0.30$	-0.342***	-0.120	0.0202	0.182***	0.191***	0.291***

*** = in 95% of periods the correlation is significant at 1% level, ** = in 95% of periods the correlation is significant at 5% level, * = in 95% of periods the correlation is significant at 10% level
 Note: Listed here is the average correlation coefficient over 80 periods, starting 20 periods after the initial period

The upper left cel of Table 3.2 summarizes the correlation between health and the insurance decision for a sample with $\alpha = 0.85$ and $\gamma = 0.05$. This homogeneous sample is our baseline. The given correlation of -0.596 is the average of the correlation between health and the insurance decision in periods 20 to 100 of the simulation. The first 20 periods are ignored, as in these periods the steady state might not yet have been reached. Instead of normal standard errors, significance is displayed as the significance level at which 95% of the per period correlations is significant.

The other cels of Table 3.2 report the correlation between health and the insurance decision for a sample with individuals that are heterogeneous in α , γ , or both. The heterogeneous sample is comprised of 50% individuals with the baseline value of α and γ , and 50% individuals with the value for α and γ that is specific for that cel. For example, the upper right cel of Table 3.2 gives the correlation between health and the insurance decision for a sample of 50% individuals with $\alpha = 0.85$ and $\gamma = 0.05$ and 50% individuals with the same γ ($\gamma = 0.05$), but with $\alpha = 0.6$. Moving from the upper left cel towards the right, the heterogeneity in preference parameter α increases. Moving from

the upper left cell below, the heterogeneity in risk aversion γ increases. Increasing the heterogeneity in α while holding γ at the same level, changes the correlation between health and the insurance decision from significantly negative to significantly positive. In other words, increasing the heterogeneity in preferences causes the selection pattern to switch from adverse into advantageous. By introducing heterogeneity in only risk aversion parameter γ , it is much harder to generate positive correlation. Increasing γ from 0.05 to 0.30 lowers the negative correlation from -0.596 to -0.342, but the negative sign remains and is highly significant. An unrealistically high value of γ would be needed to generate a positive correlation between health and the insurance decision due to heterogeneity in only γ (even a value for γ of, for example, 0.7 is still not enough to generate this positive correlation). Having heterogeneity in both α and γ accelerates the movement towards a positive correlation between health and the insurance decision compared to having heterogeneity in only one of these parameters.

Note that the change of sign in the correlations is only generated by a difference in dynamic effects resulting from a difference in preferences (α) or risk aversion (γ), and that all individuals have the *same* probability of a shock, irrespective of α and γ .

3.3.2 Full model

In the full model, individuals can save part of their income Y to use at a later moment (see budgetconstraint in equation (3.3)). The optimal level of the choice variables now not only varies with the health level at the start of the period, H_{t-1} , but also with the wealth level at the start of the period, W_{t-1} . Figure 3.6 is the full model-equivalent of Figure 3.2 and shows the optimal levels of the choice variables at different levels of H_{t-1} and W_{t-1} . The upper left panel of the figure shows valuefunction V_t , as estimated with the fixed point procedure from subsection 3.2.2. The optimal insurance decision is shown in the upper right panel. The probability that buying insurance is optimal increases when health decreases and/or if wealth increases. The four lower panels show the optimal levels of total health investments and consumption when the individual is not hit by a shock (on the left) and when he is hit by a shock (on the right).

As for the model without wealth, the full model is simulated for 100 periods to investigate whether health and insurance choice are negatively or positively correlated. Again, 250 simulations are performed that only differ in their sequence of draws from the distribution of health shocks. Table 3.3 is analogous to Table 3.2 and gives the correlation between health and insurance status for different compositions of a heterogeneous sample.

Clearly, the baseline model without any heterogeneity leads to a pattern of adverse selection (upper left cell). The first row shows how introducing more and more heterogeneity in α changes this pattern gradually into one of advantageous selection.

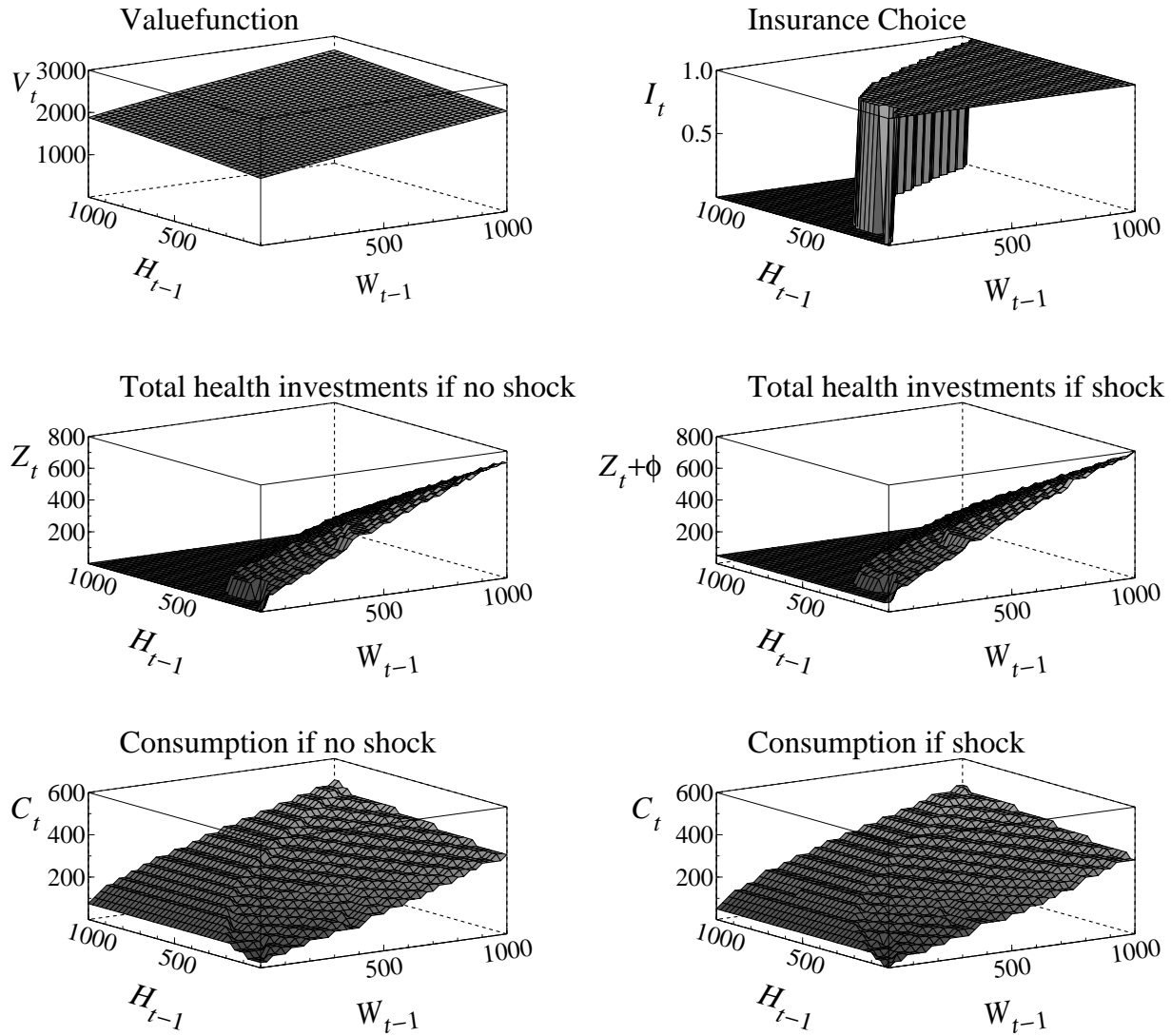
Figure 3.6: Optimal choices in full model with $\alpha = 0.85$ 

Table 3.3: (Average) correlation coefficients of health and insurance choice for a sample with 50% individuals with the baseline value for α and γ and 50% individuals with $\alpha = \alpha'$ and $\gamma = \gamma'$, full model

	$\alpha' = 0.85$	$\alpha' = 0.80$	$\alpha' = 0.75$	$\alpha' = 0.70$	$\alpha' = 0.65$	$\alpha' = 0.60$
$\gamma' = 0.05$	-0.514***	-0.231***	-0.178**	-0.075	0.046	0.134
$\gamma' = 0.10$	-0.350***	-0.158**	-0.074	0.040	0.077	0.142*
$\gamma' = 0.15$	-0.393***	-0.174**	-0.044	0.117	0.059	0.164**
$\gamma' = 0.20$	-0.346***	-0.143	0.007	0.134*	0.108	0.161*
$\gamma' = 0.25$	-0.313***	-0.079	0.067	0.124	0.157***	0.210***
$\gamma' = 0.30$	-0.313***	-0.070	0.076	0.080	0.171**	0.300***

*** = in 95% of periods the correlation is significant at 1% level, ** = in 95% of periods the correlation is significant at 5% level, * = in 95% of periods the correlation is significant at 10% level
 Note: Listed here is the average correlation coefficient over 80 periods, starting 20 periods after the initial period

Again, as for the model without wealth, generating patterns of advantageous selection due to heterogeneity in only γ turns out to be much more difficult and would require unrealistic values of γ , but heterogeneity in γ does reinforce the effect of having heterogeneity in α .

3.4 Conclusion

This chapter showed that in a simple model with homogeneous individuals, except that they differ in the realization of the sequence of (possible) health shocks, adverse selection will arise in the market for health insurance. Individuals that are more often hit by a health shock and consequently have a lower health stock are the ones that are most likely to buy health insurance. De Meza and Webb (2001) argue that the empirical finding of exactly the opposite of this textbook example of selection, advantageous selection, where the good risks instead of the bad risks insure themselves, can be explained by precautionary effort and insurance purchase being positively correlated. They reason that this positive correlation can arise when there is heterogeneity among individuals in their risk aversion or preferences. In this chapter a model in which utility is derived from both health and consumption, and that allows for investing in health, was simulated for multiple periods. I showed that in this dynamic setting the positive correlation between precautionary effort (health investments) and insurance purchase arises naturally with the introduction of just one of the types of heterogeneity mentioned by De Meza and Webb. However, with only heterogeneity in preferences this result was much easier to obtain than with only heterogeneity in risk aversion.